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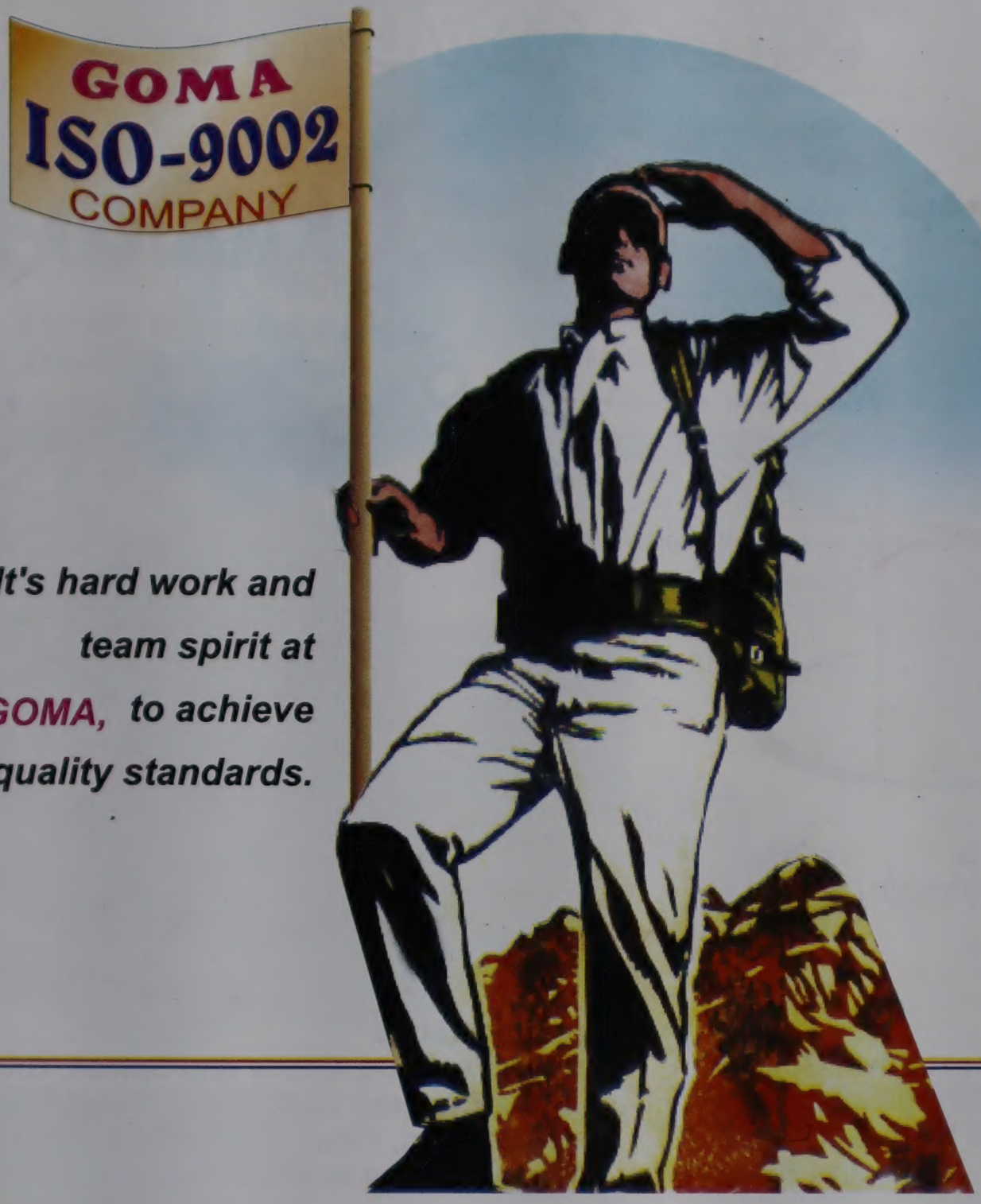


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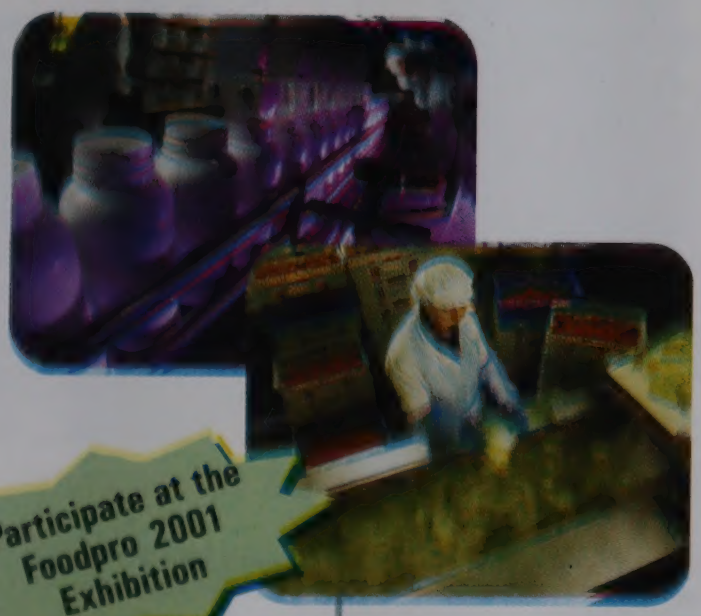

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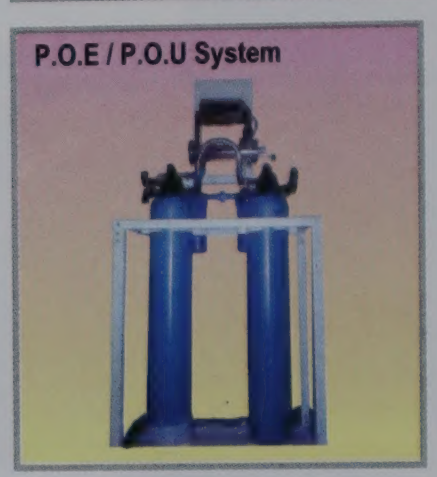
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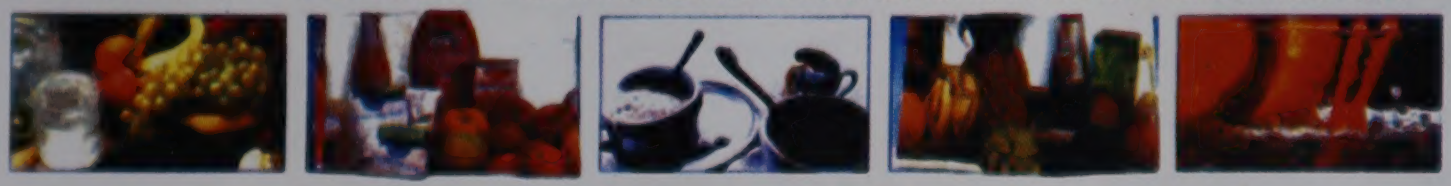

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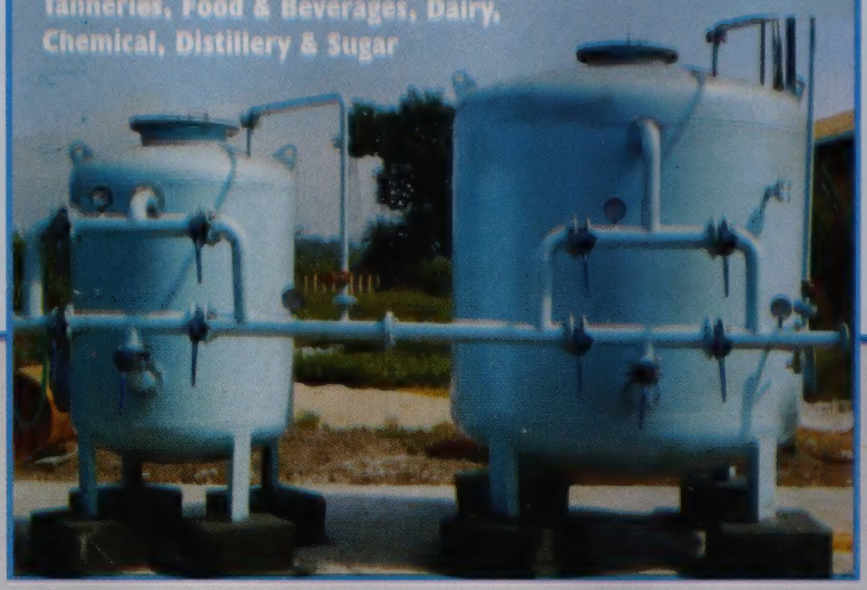

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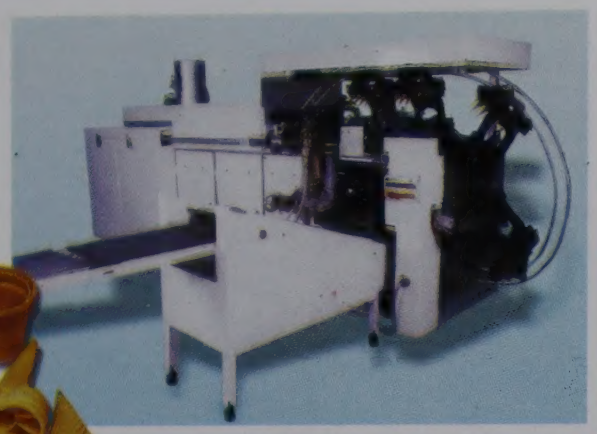
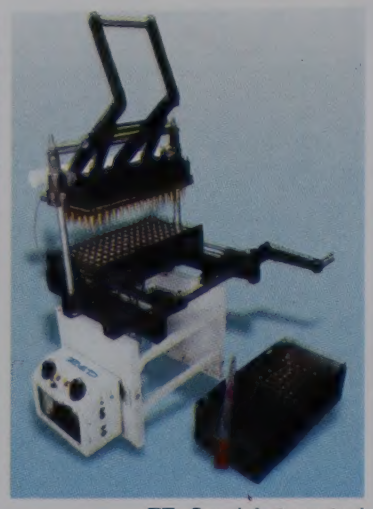


ZA: Automated baking Machine



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# Membrane Technology and its Application in Food Industry

by
**Zeynab Raftani Amiri** and Dr. Y.K. Jha***

**Abstract:**
***Filtration is a unit operation for the mechanical separation of food components. Filtration processes are usually classified according to the molecular size of components retained by the filtermedia. Two major classes can be identified: Conventional Particle Filtration (C.P.F.) and Membrane Filtration (M.F.).***

In membrane technology, water and some solutes in solution are selectively removed through a semipermeable membrane in which the driving force for transport is pressure. Ultrafiltration, Reverse Osmosis, Microfiltration and Nanofiltration are included in membrane separation technology.

The main role of a membrane is to act as a relative barrier. It should permit passage of certain components (permeate), but retain certain other components (retentate) of a fluid mixture. The membrane may be made of organic (polymers) or inorganic (mineral or ceramic) material. The mineral membranes have greater thermal, chemical and mechanical stability but still are costly and are only preferred where the end products are of very high value.

Energy requirements of membrane processes are very low compared with others such as evaporation, freeze concentration and freeze drying. They can be operated at ambient temperature, by minimum changes in pH, and ionic strength of feed, thus resulting in better nutritional and functional properties of food constituents. However, membrane processes are quite limited in their upper solid limits, fouling and cleanings of them.

The largest commercial food application of membrane filtration is the concentration of whey from cheese manufacture. It is also used to concentrate and purify juices prior to evaporation, clarify wine and beer, demineralise and purify water, separation and concentration of enzymes, demineralization and delactosation of dairy products and water treatment to remove bacteria and contaminants.

Membrane filtration has been one of the most widely used techniques in one form or another for almost 100 years, yet it is only since the late 1940's that the membrane filter has become a readily available commercial product. The use of membrane filters in biochemistry was a major advance in 1950's, when radio isotope technology became widespread. For the last two decades, membrane technology is getting much attention in different areas of the food industry. The dairy industry is the heaviest user, where it is principally used to concentrate cheese whey upto 24% total solids content. Other uses in the dairy industry include concentration of milk and permeate from the ultrafiltration of whey. Nanofiltration is used to demineralize whey partially whilst preconcentrating it prior to full demineralization by ion exchange.

In the fruit juice industry, reverse osmosis is used to concentrate a variety of juices, including apple, orange and tomato. In most cases the concentration is limited by osmotic pressure to 24-30°Brix. However, there are new developments that are achieving over 50°Brix.

* *Department of Food Science and Technology, G B Pant University of Agriculture and Technology, Pantnagar 263145, India*
** *Mazandaran University, P.O. Box 578, Sari- Iran*

Other applications include dealcoholization of beer and wine, concentration of egg white, concentration of effluent streams and number of commercially sensitive applications.

Membrane technology is also being used in biotechnological process. Ultrafiltration can be used to harvest microorganisms from fermentation broths with much higher recoveries than with traditional filtration and centrifugation processes. For example, hollow fibre ultrafilters can give 100% rejection of *Lactobacillus bulgaricus* cells in a whey permeate fermentation broth. The fouling problem with UF membranes during cell harvesting is less than with microfiltration processes. The enzyme extracted from plants and animal tissues can also be purified by the ultrafiltration process. UF membranes containing immobilized enzymes or whole microbial cells function as continuous bioreactors. These bioreactors have been used increasingly to provide an opportunity for greatly improving the performance and productivity of fermentation. UF is also used for the production of high quality water suitable for pharmaceuticals and other biotechnology purposes. The most efficient removal of pyrogens, bacteria and particulates at low energy are the main advantages of UF over other water treatment techniques.

Other useful applications of UF in the food industry are production of concentrates and isolates from soya, sunflower, cotton seeds, removal of glucose from egg white and its partial concentration prior to drying, refining of sugar solutions, fractionation and concentration of gelatin.

Filtration is an unit operation for the mechanical separation of food components. Filtration is used to clarify liquids by separation of solids from liquids by passing the mixture through a bed of porous material.

**Filtration can be divided to two major classes:**
Conventional particle filtration (C.P.F.) and membrane filtration (M.F.)

| | | C.P.F. | M.F. |
|---|---|---|---|
| 1. | Size of separated particle | Molecular size > 10μ | Molecular size < 10μ |
| 2. | Degree of separation | Suspended material can be separated completely from liquid | Only concentrates of the retained material in smaller quantity relative to the original liquid. |
| 3. | Pressure | Gravity is the main force, but pressure can apply only to accelerate the process. | Use of pressure, as driving force is essential. |
| 4. | Filter media | Thick open structure of filter media is used. | Thin membrane of control pore size is used. |
| 5. | Process design | Flow of feed stream is perpendicular to filter media. | Cross flow or tangential flow design |

**Membrane filtration is sub-divided into four classes:**
1. Reverse Osmosis; 2. Nanofiltration; 3. Ultrafiltration; 4 Microfiltration.

The separation characteristics of different membrane processes are shown in Fig: 1 and Fig. 2.

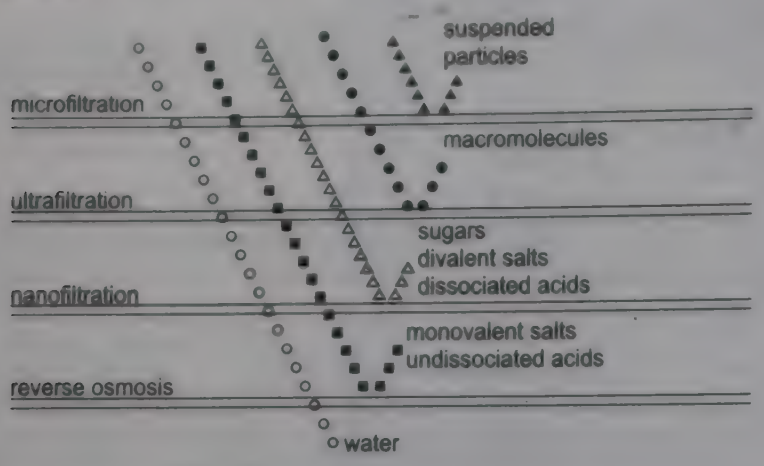
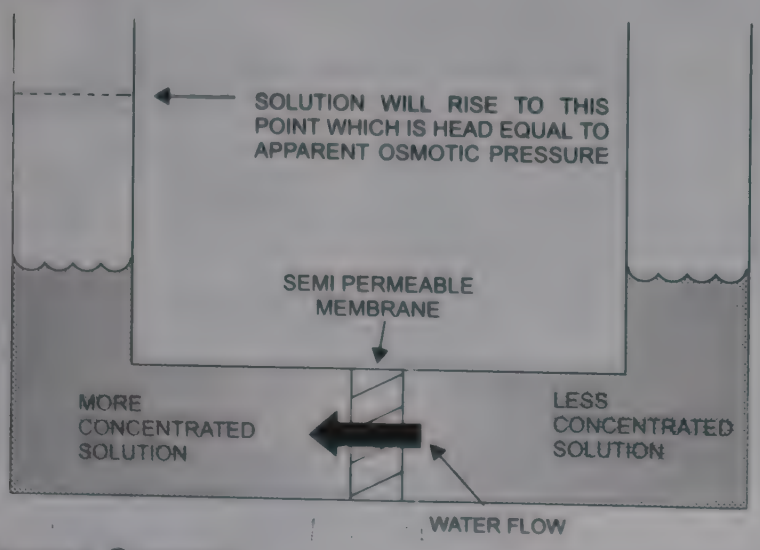



Fig. 1 Separation of Constituents through membranes

| Particle Size (μ) | 0.0001 | 0.001 | 0.01 | 0.1 | 1.0 | 10 | 100 |
|---|---|---|---|---|---|---|---|
| MW (D) | 100 | 1000 | 10,000 | 100,000 | | 500,000 | |
| Particle | ionic | molecular | | macromolecular | | cells | |
| Milk System | ions, salts, lactose | WP, caseins, vitamins | | fat, protein aggregs | | yeats, bacteria | |
| Process | RO, NF | UF | | | | MF | |

## Osmosis:

Normal osmosis takes place when water passes from a less concentrated solution to a more concentrated solution through a semi-permeable membrane. Water will flow because of energy difference from the less concentrated to the more concentrated solution until the system is in equilibrium.


SOLUTION WILL RISE TO THIS POINT WHICH IS HEAD EQUAL TO APPARENT OSMOTIC PRESSURE
SEMI PERMEABLE MEMBRANE
MORE CONCENTRATED SOLUTION
LESS CONCENTRATED SOLUTION
WATER FLOW

## Reverse Osmosis:

Reverse Osmosis is the process where a solvent, usually water, is driven from a solution across a semipermeable membrane. This is accomplished by applying pressure to the solution in excess of the osmotic pressure of that solution. Some of the solute species will also diffuse through the membrane, but they will pass through the membrane at a lower rate than the solvent membranes.

It is normal to operate reverse osmosis in a cross-flow mode, where the process fluid is pumped tangentially across the membrane surface, becoming more concentrated as it passes along the length of the membrane. The concentrated solution is then removed from the system.

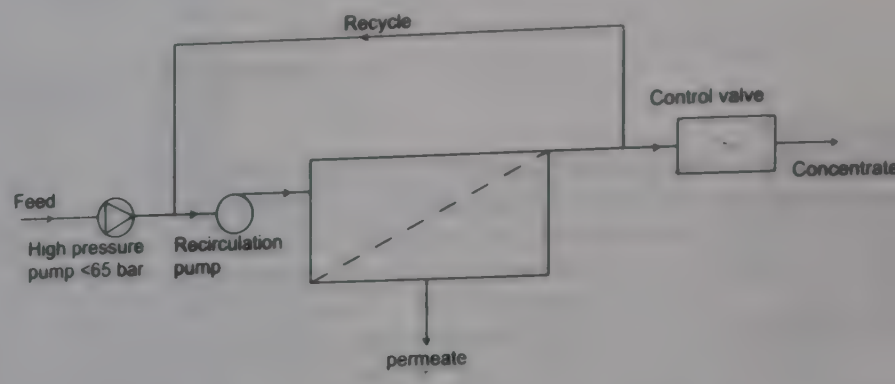
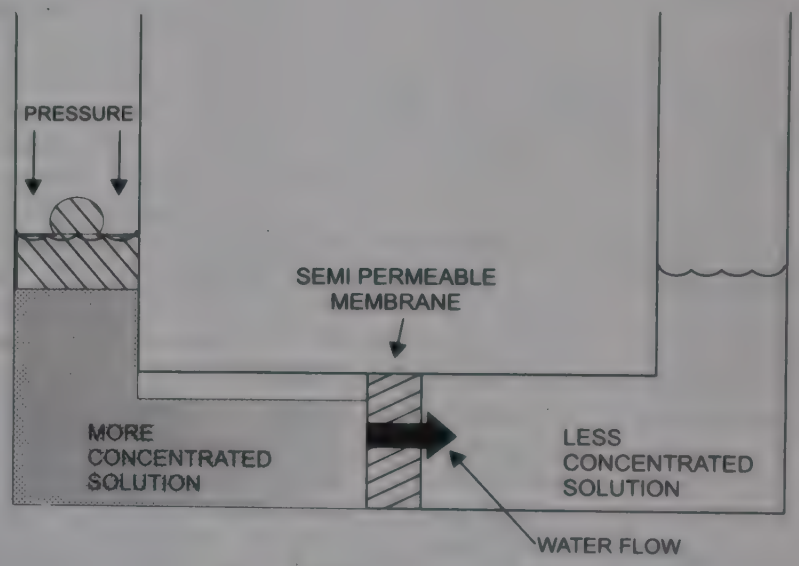



**Fig. 3: Essential components of a RO plant**

By applying pressure greater than osmotic pressure at the more concentrated solution sides, the water will begin to flow from the concentrated solution to the less concentrated solution.

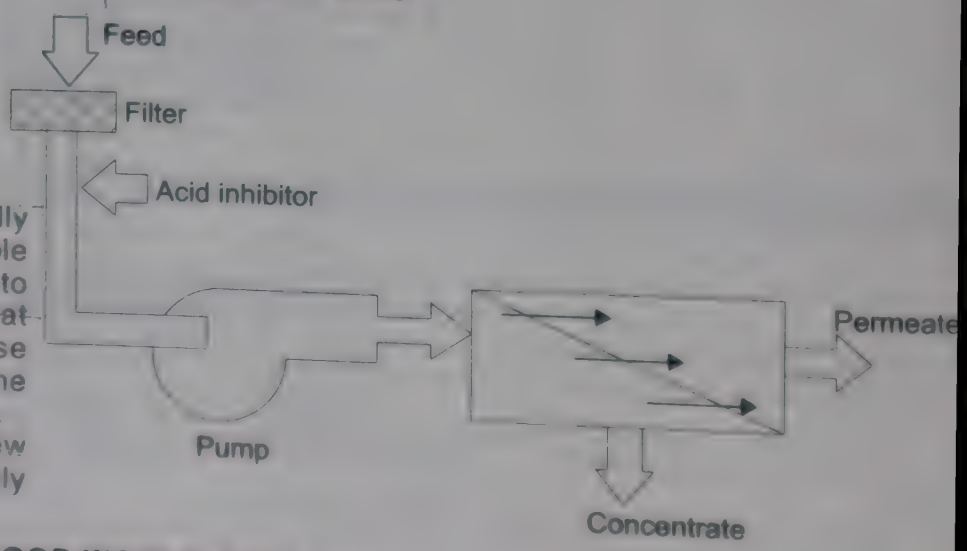



## Reverse osmosis filtration (Hyper filtration)

- In reverse osmosis filtration only water passes through the membrane, everything else including ions, organic molecules which have a molecular weight about 100 Daltons are retained.
- Pore size of membrane is about 1-10A.
- Porosity is about 50%
- Operating pressure is 1500 psig.

## Application of R.O.

- Purification of water



— Concentration of whey and milk prior to evaporation.
— Concentration of raw and clear depectinized juice from fruits and vegetables (Tomato juice, orange juice, apple juice, beet juice).

The cleaning is an essential step to maintain the efficiency of RO plant. This may be done by using a CIP system. The exact cleaning process used, depends on the type of soil and the membrane. A typical sequence will involve displacing the process fluid with water, rinsing the plant, cleaning with an acid, rinsing and then possibly sanitatizing before returning to the process.

In plants using cellulose acetate (CA) membranes and operating on protein rich feed, it is preferable to use enzymatic detergents (0.25-0.50% concentration) at neutral pH. When thin film composite membranes are used, it is adviseable to select a caustic-based detergent to clean at a pH value of 10.5-12.5. The advantages over the use of enzymatic detergents are, lower cost of detergent, shorter cleaning cycle and easier automation of detergent dosing during cleanings.

When cheese whey is processed or hard water is used for cleaning it is necessary to used an acid to remove scales from the membrane. CA membrane can be sanitized with low concentration of free chlorine (50 ppm). Polyamide membranes, however, are intolerant to chlorine, but they may be sanitized with hydrogen peroxide, peracetic acid, sodium metabisulphite or hot water.

**Nanofiltration:**

This process is an extension of reverse osmosis and is also known as loose reverse osmosis. It provides removal of soluble mineral ions while concentrating the rest of the feed constituently.

- It allows monovalent ions and some divalent ions to pass, but retains organic molecules, which have a molecular weight over about 500 D.
- Pore size of membrane is about 10 — 100 Å.
- Porosity is about 50%.
- Operating pressure is 300 psig.

**Application:**

- For concentrating dairy fluids such as whey and milk, while at the same time affecting partial demineralization.
- Partial demineralization of milk by nanofiltration may also be valuable for manufacture of infant milk foods.
- It can be used for lactose manufacture.
- It greatly reduces the B.O.D. of these by-products.

**Ultrafiltration:**

The pressure gradient across the membrane would force the solvent and smaller species through the pores of the membrane, while the larger molecules could be retained.

The retained phase "retentate/concentrate" will be enriched in the retained macromolecules, while the permeate stream will be depleted of the macromolecules.

- The membrane allows the smaller molecules like lactose and salts to pass through, while retaining large molecules like protein (over 1000 D).
- Pore size of membrane is about 100 Å — 1000 Å.
- The porosity of membrane is about 60%.
- Operating pressure is 10-20 psig.

**Application:**

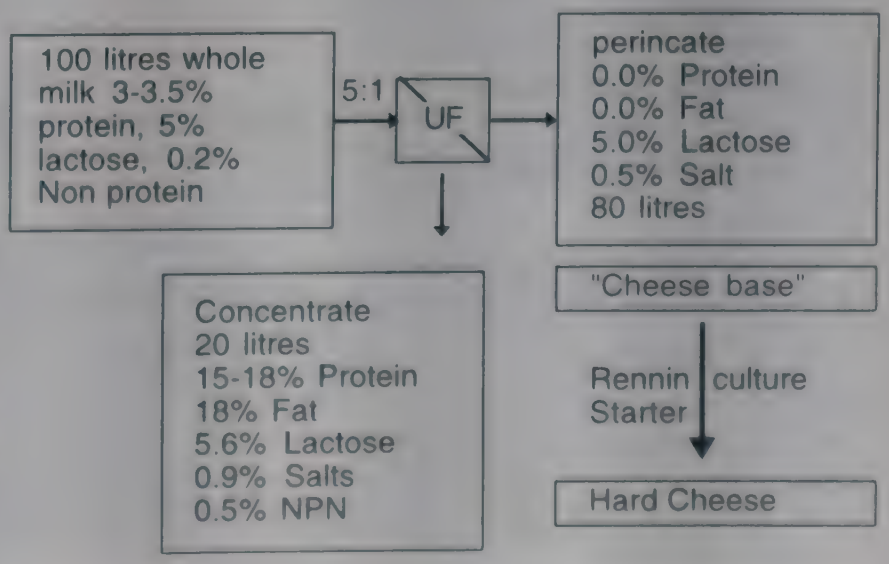
- It is used for clarification of fruit juices (Apple, orange, lime, grapes).
- It is possible to make good quality channa from ultra filtration retentate. Channa making is principally a method of concentrating protein and fat of milk by the action of heat and acid.

Skim Milk (95% T.S.)
↓
Severs heating (95°C, 5 min)
↓
Cooling (50° C)
↓
Ultra filtration → permeate (5.6% T.S.)
↓
Addition of water → U.F. retenate (26.73% T.S.)
water (50°C) ↓
Dia filtration → permeate (3.08% T.S.)
↓
U.F. dia filtrate retenate (23.57% T.S. 17.5% protein 1% lactose)
↓
Cooling (10°C)
↓
Addition of plastic → Stored at -35°C until used
cream ↓
(66% fat, 70% T.S.) Channa mixture (36% T.S., 13 % protein, 18% fat)
↓
Heated to 85-90°C for 5 min
↓
Addition of Lactic acid
↓
Cooling (50-60°C)
↓
(43% T.S.) Channa ← Pressing→ whey (16.16% T.S.)

— Manufacture of whey protein concentrate

1000 L sweet whey
↓
Pre treatment
↓
Ultra filtration → 900 L permeate
↓
100 litre retentate
↓
Dia filtration → 150 L permeate
↓
50 L retenate
100 Lit water → ↓
Evaporation (spray drying)
↓
7.95 kg whey protein powder
2.5% moisture
72% protein
19% lactose
6.8% mineral

- Purification of water, beer and wine.
- Manufacture of low lactose powder.
- Enzyme recovery in various operations eg. Lactose hydrolysis by soluble lactose preparation.
- Production of high protein cheese base from whole milk.



**Microfiltration**
Micro filtration is essentially a method of separation of suspended particles from dissolved particles in feed stream such as:

- Bacteria
- DNA (0.5 - 5.0μ)
- Viruses (< 1000 Å)
- Blood cells
- Starch (~ 10μ)
- Fat globules and passage proteins.

— Pore size of membrane is $10^3$ - $10^5$ Å
— Porosity of membrane is about 70%
— Operating pressure is 1-25 psig.

**Application:**
— Removal of residual fat (phospolipid protein) from whey.
— Separation of native casein and whey protein from skim milk.
— Sterilization of beer and wine.

**Materials of membrane:**
Membrane is considered to be the heart of a membrane process because it acts as a selective barrier.
The membrane may be made of:
— Organic (polymer)
— Inorganic/mineral (ceramic)
Many materials have been tried for membranes, but not all of these are available for commercial use, only some of them are suitable for food application. The most common materials used are:

**Organic**

**1- cellulose acetate (C.A.)**
Cellulose acetate is widely used despite its limitation. This material is used in M.F., U.F., N.F., and R.O.

**Advantage:**
— C.A. is more hydrophilic than other polymers.
— C.A. is easy to manufacture in variety of configurations and pore size.
— The raw material, cellulose, is a renewable material.

**Limitation**
— Narrow range of temperature (max. 30°C)
— Narrow range of pH (4-6)
— Poor chlorine resistance
— It is susceptible to microbial attack.

**2-Poly Amide (P.A.)**
This material is used for U.F., N.F., and R.O.

**Advantage**
It is capable of higher pH (4-11) and higher temperature (up to 60°C).

**Limitation:**
It is sensitive to chlorine.

**3-Composite membrane:**
Thin film composite membranes generally contain two layers, the upper layer is polyamide and lower layer is polyethylene. They are available only for N.F. and R.O.

**Advantage:**
— Better stability at the range of pH 3-11.
— Better stability at the temperature of 60°C (sometimes to 75°C)
— Better durability.

**Limitation:**
They are sensitive to chlorine solution.

**4-Mineral:**
— Alumina, Zirconia, carbon composite, silica and stainless steel are used.
— They are available for M.F. and U.F. and their pore size is about 10μ.

These systems are best in the process which demand high value of sanitation and continuo operation especially in biotechnology, food processing & pharmaceutical processing. .

These systems are easy to clean by C.I.P. systems and give higher flux and concentration because of higher operational pressure and velocity.

They have greater thermal, chemical and mechanical stability. However, still the mineral membrane system is costly and only prefered where the end products are of very high value.

**Operating parameters in membrane filtration**
The operating parameters that affects performance of membrane systems are:
— Pressure
— Feed concentration
— Temperature
— Velocity/flow rate

**Pressure**

$$J = \frac{\varepsilon\, d^2 P}{32 \times \mu}$$

J = flux
d = diameter of pore
ε = surface porosity
x = membrane thickness
μ = viscosity of fluid
p = applied transmembrane pressure
Applied pressure is difference between net hydrolic pressure and net osmotic pressure:

$$P = (P_f - P_p) - (\pi_f - \pi_p)$$

π = osmotic pressure  P = hydrolic pressure
f = feed  p = permeate

**Feed concentration:**
The flux will decrease exponentially with increasing feed concentration.

$$J = KL_n \frac{C_s}{C_f}$$

J = flux
$C_s$ = concentration of solutes at membrane surface
$C_r$ = concentration of solutes in feed
K = mass transfer coefficient

**Temperature:**
In general higher temperature will lead to higher flux, and it is best to operate at the highest possible temperature consistent with limits of the feed and membrane.

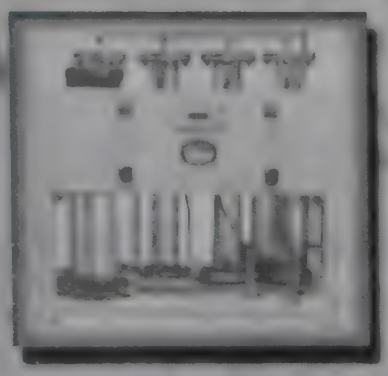
This assumes that there are no other induced effects such as salt precipitation, protein denaturation or other fouling phenomenon.

**Velocity/Flow rate:**
By increasing the velocity, the accumulated solids near the membrane surface are swept away and the turbulence reduces the thickness of the boundary layer.

**Design of membrane:**
A variety of membrane equipments designs have been developed while they differ in size and shape of the flow channels, in which the membrane are housed. they all are designed to provide sufficient pressure differences across the membrane to enable mass transfer to occur.

Additionally, in the processing of food materials, particular attention is paid to cleaning and sanitization and material construction.

# WATER Purification Systems



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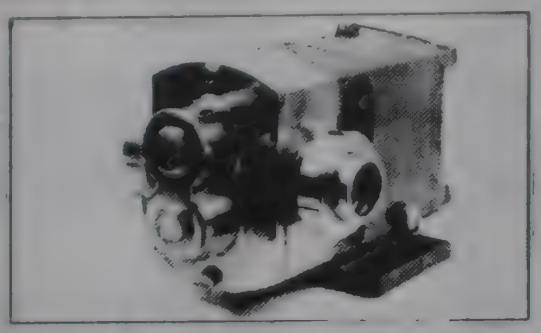

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Four basic membrane designs have evolved:
1. Tubular
2. Plate and frame
3. Spiral wound
4. Hollow fibre.

**Tubular:**
Membrane can be formed on the inside of the tube. The membrane ranges from 6-25 mm inside diameter and may be cast directly on to a porous support structure, such as a fiber glass-resin tube, which forms the final pressure support.

**Advantage:**
— This is easy to clean
— Individual membranes can be easily replaced.

**Limitation:**
— High pressure drop
— High velocity (Re > 10000) of feed
— High energy. consumption

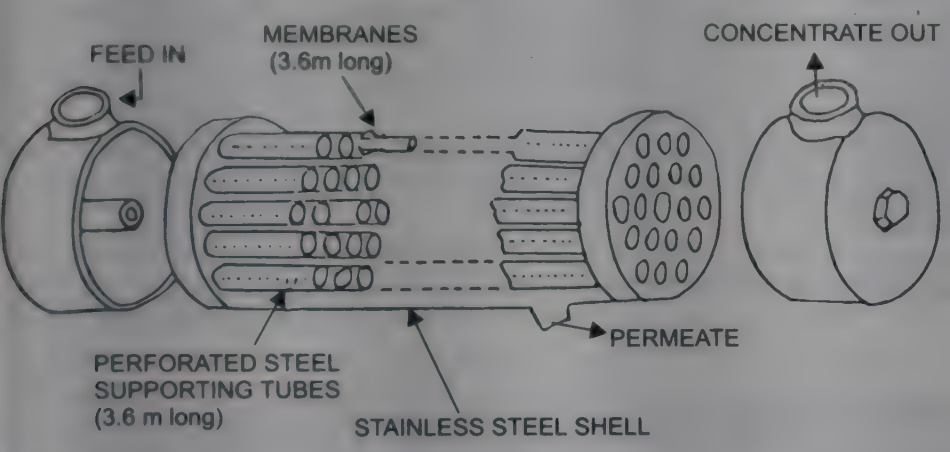
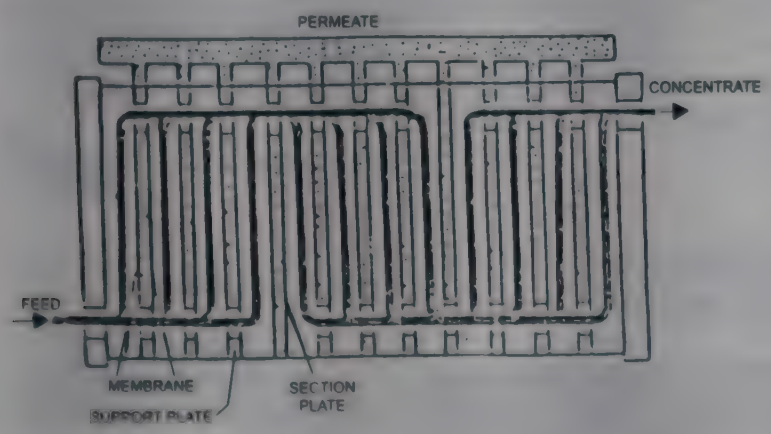



**Plate and frame:**
Membrane are cast insheet form on to a flat surface which is commonly a porous backing material such as paper or plastic.

**Advantage:**
— Economic in energy consumption
— It is applicable for viscous solution
— Replacement of membrane on site is easy
— Operating in laminar flow

**Limitation:**
— Difficult to clean
— Susceptible to plugging




**Spiral Wound:**
They are typically formed from a "Sandwich" comprising two flat sheets of highly porous material and laid on a plastic mesh.

**Advantage:**
— Compact and high surface area per volume
— Minimum energy consumption
— Low capital and operating cost

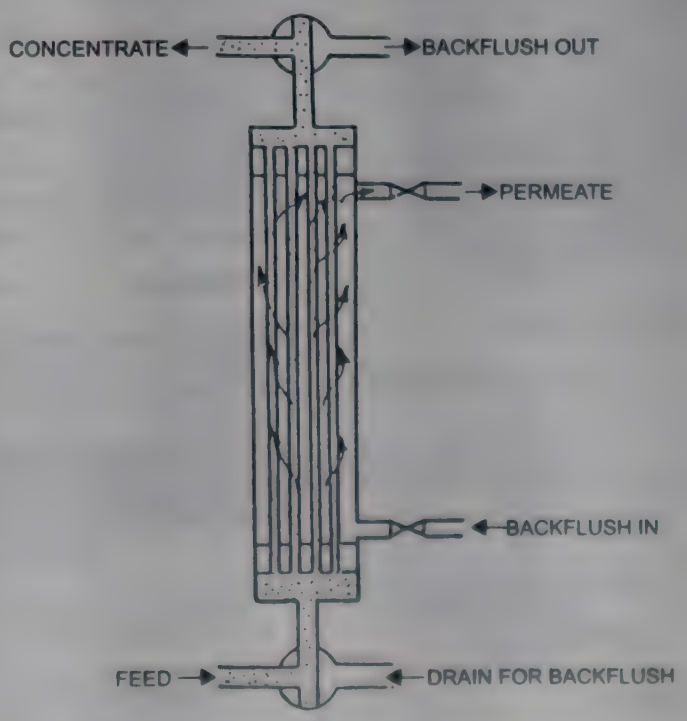
**Limitation:**
— Difficult to process of fluid by high suspended solids
— High pressure drop
— Faulty membrane elements, requires charging the whole membrane

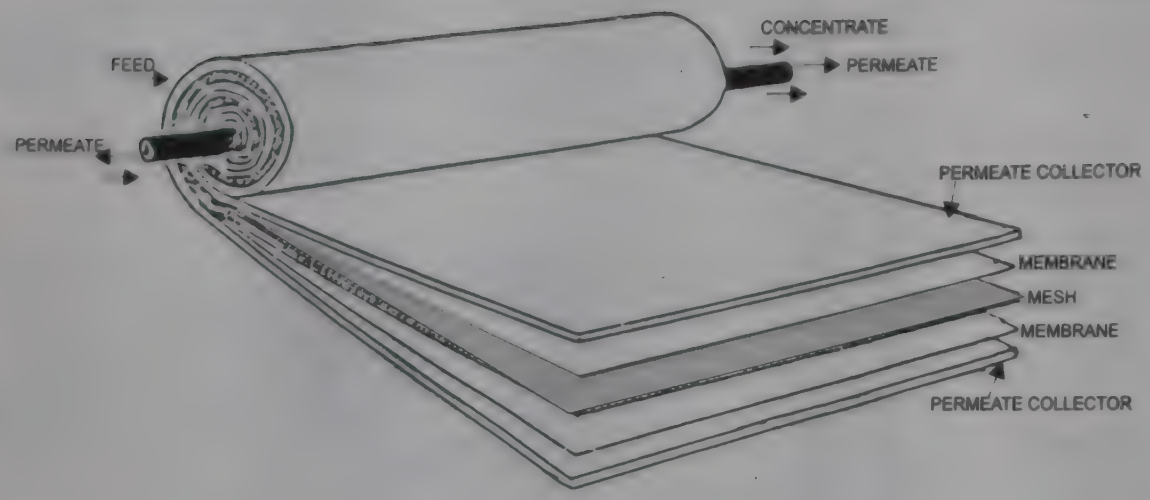
**Hollow fibre:**
With an internal diameter in the range 0.5-1.0 mm these membranes are produced by extruding a polymer solution through an orifice into gelation batch. The fibre are oriented in a resin at their end and enclosed in the permeate collecting tube. The feed stream flows through the inside of the fibre and the permeate is collected outside and removed at the top of collection vessel.

**Advantage:**
— It has highest surface area per volume
— Improved cleanability by back flushing
— Low energy consumption

**Limitation:**
— Fibre are susceptible to plugging at the cartridge inlet.
— Difficult to maintain high flow with high viscous solution in low cartridge.
— Low maximum pressure followed

**Advantage of membrane filtration:**
- Membrane filtration is a simple process. It consists merely of pumping the feed solution under pressure over the surface of a suitably supported membrane.
- The energy requirements are very low compared with other water removal processes like evaporation, freeze drying, freeze concentration etc.
- The process can be operated at ambient temperature thus thermal or oxidative degradation problems can be avoided. Thus the nutritional and functional properties of feed constituents, like colour, flavour, vitamin, proteins are least affected.
- No complicated heat generating equipment is needed and only electrical energy to drive the pump motor.
- There are minimum changes in the "pH" and ionic strength of the feed being used.






**Limitation of membrane filtration:**

To replace an old system with the new one, generally only it's advantage are considered, but for a balanced approach, the inherent limitations of the new process being adopted must also be taken into consideration.

- Membrane processes are quite limited in their upper solids limits. As an example, current technology permits skimmed milk to be concentrated by multi effect evaporation to about 50% T.S., while the upper limits using R.O. is about 30% T.S.
- High initial capital cost of the equipment
- Inadequate technological experts of plant trouble free processing conditions
- Other problems such as the fouling and cleaning.

**New application of membrane filtration:**

- Production of pasteurized milk with extended shelf life. (By microfiltration for skim milk more than 99% removal o bacteria.
- R.O. for milk transportation o raw milk.
- Milk protein standardization.
- Fractionation of milk protein

Lipoprotein in milk fat globule membrane > Casein micelles > Immunolobulins > Lacto ferrin > Serum albumin > β Lacto globulin > α lactalbumin > Casein-derived peptides.

- Demineralization and delactoration of dairy products.

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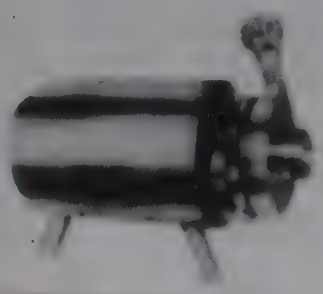
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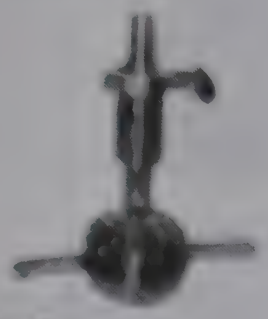
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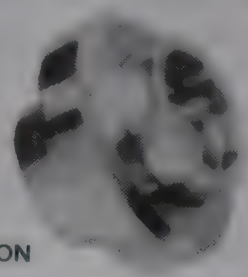
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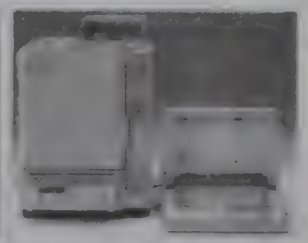

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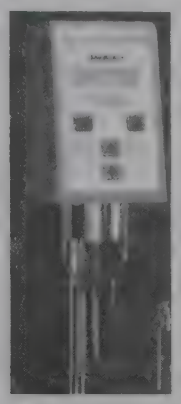

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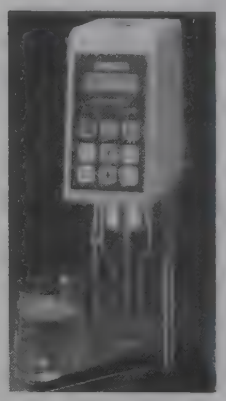

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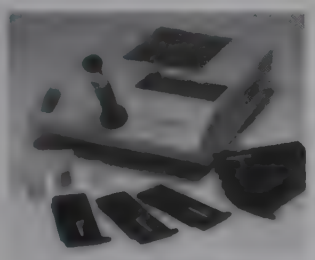

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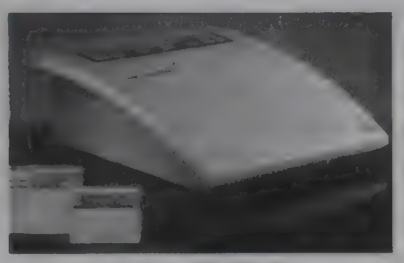

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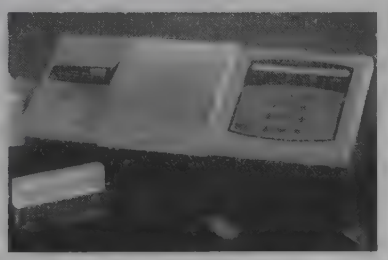

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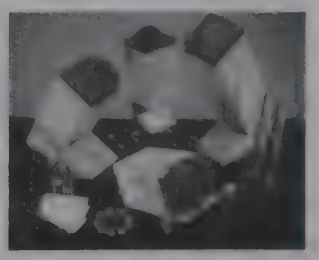

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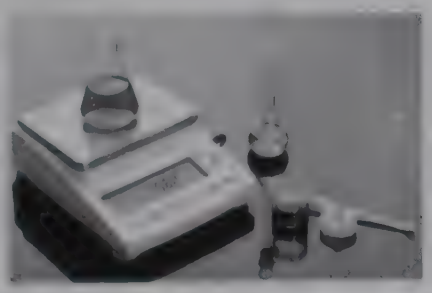

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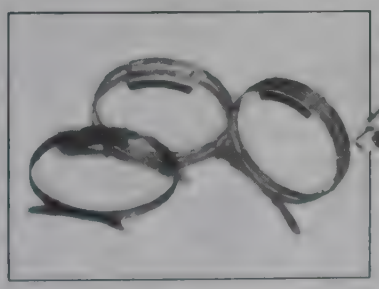

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# Ultraviolet Disinfection of Water in the Food Industry — Is it effective & Reliable ?

by
**V. A. Raju**

Ultraviolet (UV) disinfection of water is now being increasingly used in the food & beverage industry, which is going through a phase of incorporating HACCP (Hazard Analysis at Critical Control Points), HASSOP (Hygiene and Standard Sanitation Operating Procedure), EEC (European Environment Committee) & cGMP normal in the production lines.

In the food & beverage industry purified water is required in the washing, rinsing & manufacturing process.

It is imperative that the water meets the standards of microbial quality required as per the norms to obtain a good quality end product.

UV as a disinfection methodology is chosen to achieve standards of water with required microbial quality since it has proven to be safe, easy, convenient, reliable, dependable, and cost effective with minimal maintenance requirements and no addition of any chemicals.

However it must be understood that UV is only a useful tool in water treatment and it is not a magic wand to remove all bacteria. It has to be applied and used properly to achieve desired results with respect to bacterial disinfection. UV does not change the physical or chemical characteristics in water at all and can provide very high disinfection efficiency upto 99,99% in a properly designed and sized system, but will not give sterile water.

UV Systems are effective and reliable only when the system is properly designed, sized installed, maintained, monitored and understood by the user.

Given below are some factors you should consider when you go in for and UV system.

**Design of UV system:**
UV is a very specialized and complex subject requiring experts in that field who understand the functioning and limitation of the systems with reference to the electrical, electronic, mechanical, hydraulic, physics, chemistry and microbiology parameters to be able to design an effective UV system.

There is a common misconception that UV is a subject, which can be handled by the Water Treatment Company who supplies the other water treatment equipment.

However that is not true since most of the systems which are fabricated by local manufacturers are done without any design data or understanding the fundamentals of the UV subject, which is highly technical and specialized.

These types of manufacturers would be unable to provide proper advice and backup support to achieve the required standards of microbial quality in the water.

You would not get yourself operated for an heart ailments by your general practitioner who is also a doctor but you would go to a heart specialist, similarly it is advisable to talk to professionals and experts in the UV field when your are considering a UV system for food applications where the quality of water is very critical.

**Sizing of a UV Systems:**
This is dependent on

a) The quality of input water to the system (Physical and Chemical characteristics)
b) The type & quality of micro-organisms present in the water
c) The end application of the purified water
d) The peak hour flow rate.
e) Location of the system

Since all these factors are critical to ascertain a suitable UV configuration for a particular application, it is important to deal with a UV application specialist for proper advice and guidance.

**Installation of a UV System:** Since UV as a principle provides disinfection on contact and has no residual disinfection properties, care should be taken to install the system as close as possible to the point of use to avoid chances of subsequent contamination.

Here again it is important to realize the need of providing a return closed looped line which is in constant circulation to prevent any stagnation and have a standard procedure of sanitation of the pipe lines to reduce the biofouling which takes place in the pipeline.

**Maintenance of UV Equipment:**
This involves replacement of the lamps at regular intervals, cleaning of the quartz glass based on the quality of input water and cleaning of the purification chambers regularly.

It is advisable to maintain a set of spares always to enable quick and timely replacement.

Here it is important to deal with a company, which provides dependable service.

**Monitoring of a UV System:**
This is the most important factor to ensure consistency of the UV units performance to make it reliable.

Monitoring has to be on-line to determine the UV dosage, which is available to any organism, since the UV dosage will determine the disinfection efficiency of the systems.

The on-line monitoring is important since there are factors, which are not apparent but likely to occur at any time and adversely effect the quality of water output.

Here again care has to taken to ensure that the monitoring system will indicate the level of 254nm UV dosage available in the equipment. Most systems have lamp indicators or a visible monitor, which will not determine the amount of UV dosage in the system.

**Understanding of UV by the user:**
The best of systems will be useless if the end user does not know how to operate them and get the optimum efficiency It is critical that the user be trained in the operation of the equipment and understand all factors which are likely to effect the desired quality of water.

Make sure that all personnels, handling the equipment are kept well informed and trained to get the best out of your UV units.

As discussed above - UV is a very useful, effective and reliable tool for bacterial disinfection of process water, however it is a specialized subject requiring specialists to handle it to be able to get the maximum mileage from it

*Director, Ace Hygiene Products Pvt. Ltd., 222, Shah & Nahar, A-2, Lower Parel. Mumbai 400 013. India*

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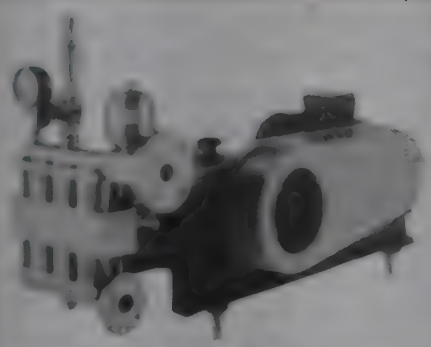

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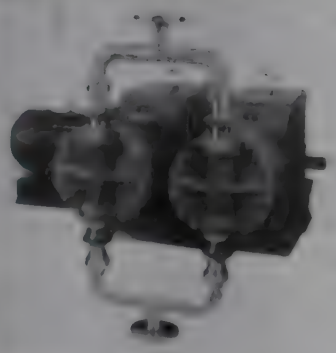

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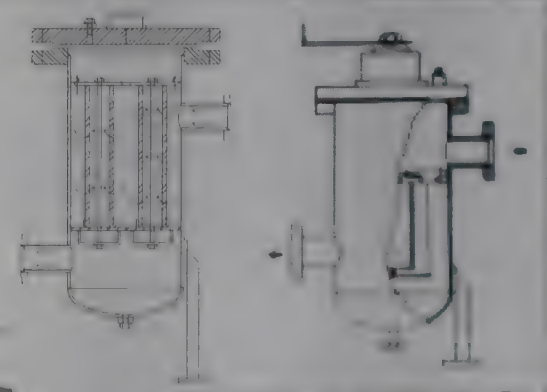

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# Water Treatment Processes used in Bottled Water Industry

by
**Mr. P.P. Kherdekar**

Water's basic purpose is to help the human body to maintain proper temperature, lubricate the system and joints, carry away toxins and quench the natural thirst. Water constitutes 70% of the human body and water borne diseases like Cholera, Dysentery, Typhoid, Jaundice, Diarrhoea account for 80% of the diseases. Increasing industrialization has resulted in high pollution levels thus making the consumable water scarce. Limited control on ground water discharges by the industry and dwindling local water supplies are making the conventional form of filtration process obsolete, thus paving way for advancement in the purification technologies. The following processes of water purification are normally adopted by various bottled water industries worldwide.

**Coagulation:**
Coagulation is the chemical reaction that occurs when a coagulating chemical is added to water. The most common coagulating chemical used is aluminium sulphate (alum) but other chemicals are sometimes used. When one of these coagulant is added to water, it reacts directly with the water and with certain minerals dissolved in the water to form floc particles. These are small jelly-like, filmy particles that look like snowflakes.

The coagulant also reacts physically with the fine particles of suspended matter in the water. These particles, which cause the water to appear turbid or cloudy, normally have a negative electrical charge on their surface. This charge causes the particles to repel one another and remain suspended in water rather than clumping together and settling to the bottom. The effect of the coagulant is to neutralize the negative charge on the suspended particles (destabilize the particles) so they can be brought together into larger clumps that are heavy enough to settle.

**Flocculation:**
Flocculation is a process of slow, gentle mixing of water to encourage the tiny floc particles to clump together and grow to a size that will settle quickly. When the particles of floc first form they are too small to be visible to the naked eye. A floc particle of this size is also too small to settle down in a reasonable time. Therefore, the process of flocculation or gentle mixing is used to bring the small particles of floc and other suspended matter into contact with each other so that they will stick together and form larger particles. By the time the floc particles grow to a size of about 1/16 inch (1.5mm) diameter or larger, they are usually heavy enough to settle down in a few minutes. Flocculation can be accomplished either by mechanical mixers or by hydraulic mixing.

**Settling (Sedimentation):**
Settling or sedimentation is the process of holding the water in quite, low flow conditions, so suspended matter and particles can settle down by gravity to the bottom of the tank and can be removed as sludge.

The purpose of settling is to remove as much of the floc and other suspended materials as possible before the water flows to the filters. Settling may be omitted som times when the water contains only a small amount suspended matter, but settling is required when a lot suspended matter is present.

**Chlorine Injection System:**
Chlorine has been used all over the world for over 75 yea as a disinfectant. Municipal water treatment units even parts of USA use Chlorine for disinfection. Chlorine oxidiz the cell wall, thereby killing the microorganisms.

Chlorine is injected by a dosing pump into the raw wat A minimum contact time of 15 minutes allows Chlorine disinfect the water. Chlorine is dosed in the raw water concentration level 10 to 15 p.p.m. The Microbial populati is drastically minimised by this treatment. The residu chlorine is finally removed in the subsequent process carbon purification.

**Multi-Media Filteration:**
Multi-Media filters represent a significant improveme over conventional low cost filters. This is primarily due improved filter bed action based on the innovative use a selection of filter media of Anthracite, Silica, Sand a Garnet.

In the multimedia filter, coarse but lighter media pa cles backwash to the top whereas finer, but heav particles remain at the bottom of the bed. The innovati lies in the selection of suitable media. This configurati has many advantages. The entire bed acts as a filter, rath than only the top few inches.

Turbidity is trapped throughout the bed, enabling t filter to hold for more solids filtered from the water befo backwashing is necessary. Suspended particle remov attributes to good clarity of water.

Multi-Media filtration permits delivery of high qua filtered water at much faster flow rates, as compared conventional sand filters.

**Granular Activated Carbon Filtration:**
Granular activated carbon (GAC) is used primarily removing organic constituents and residual disinfections water supplies. This not only improves taste and minimiz health hazards, it protects other water treatment syste such as reverse osmosis (RO) membranes and ion exchan resins from possible damage due to oxidation or orga fouling. GAC is made primarily from raw materials such nut shells, wood, coal and petroleum.

The two principal mechanisms by which GAC remov contaminants from water are adsorption and residual dis fectants are removed by catalytic reduction. GAC adsorptive properties are used to remove organics.

Generally, adsorption takes place because all m ecules exert forces to adhere to each other. GAC adso organic material because the attractive forces between GAC surface (non-polar) and the contaminant (non-pol are stronger than the forces keeping the contamin dissolved in water (polar).

The large surface area of GAC'S due to its particle s and tremendous matter of poles, which allows adsorpt to take place. However the adsorptive forces are weak e cannot occur unless the organic molecules are close to GAC'S surface.

*Director – Technical. ATCO Healthcare Ltd., Mumbai, Bottler of 'Brilliant Brand' Packaged Drinking water.*

**tening (Ion Exchange):**
dness can be removed from water by ion exchange ening. Inside the softener unit is a bed of ion exchange erial (usually resin beads or granules). The resin softening erial is made up of permanent insoluble anions to which ium cations are chemically bonded.
Hard water enters the exchange column (the softener k). As it flows through it, the hardness cations are drawn he anions of the exchange material. In the process, the dness minerals are absorbed and a chemically equivalent nber of sodium ions are released into the water. In brief, mless sodium ions have replaced the trouble-producing dness ions.
on exchange occurs literally billions of times, between the terials in the exchange column and the minerals in the er as softening proceeds. After a vast number of hardness s in the water have become affixed to the softening terial through the attraction of positive and negative arges, and most of the sodium ions have been released, unit can no longer soften the water. It has become nporarily exhausted. When the unit is regenerated, these rdness ions are washed down the drain and sodium ions m the salt brine become attached to the resin.

**ionization:**
e process used for removal of all minerals from water imarily for industrial application) is referred to as deionization. is process treats water with two ion exchange beds in order effect the removal of all dissolved salts.
As water flows through the first ion exchange bed, the ocess removes all positive ions and replaces them with drogen ions, instead of with sodium ions as in softening.
As the positive ions in the water affix themselves to the change material, the latter releases its hydrogen ions on a emically equivalent basis.
The partially treated water now flows through a second it, which contains an anion exchange bed. This second change material normally consist of replaceable hydroxyl ions and fixed insoluble cations. At this point the negative ns in the solution (the anions) are absorbed onto the anion change material. Released in their place are hydroxyl ions. All that emerges from such a two unit system is neral-free water.

**everse Osmosis:**
everse Osmosis (RO) is among the most efficient and most ective methods available to treat drinking water to an timum quality. Incorporated in the average RO design is a efilter to protect the unit from sediment and possibly the embrane from chlorine or chloramine. A semipermeable embrane separates the product water from the effluent nich is sent to drain. Activated Carbon and softener are also included at the prefiltration stage to remove taste, odour and many organic substances and also the scale forming element. The Reverse Osmosis unit effectively removes ions and aqueous salts upto 0.0001 micron diameter.

Reverse Osmosis (RO) water quality improvement systems are compact units designed to force pressurized water through a semipermeable membrane which rejects contaminants suspended in the water. The membrane permits the passage of improved water into a holding tank, resulting in reduced lead, copper, sodium, nitrates, radium, arsenic, and certain pesticides, fungicides and volatile organic and all biological contaminants.

The RO membrane is comprised of microscopic pores which allow the pressurized water molecules to pass through, consequently, large molecules and compounds containing contaminants can be left behind.

At the surface of the membrane a complete process involving dielectric interactions with other molecular forces takes place. This second mechanism is effective in rejecting or repelling charged mineral ions and preventing them from passing through into the product water.

**Ultraviolet Rays Sterilization:**
Ultraviolet light (UV) is an established alternative to chemicals for disinfection of drinking water.

UV is a very effective disinfectant against bacteria and viruses. Typical UV doses for drinking water range between 16 and 40 mws-cm$^2$ depending on the application, water quality, equipment chosen etc. The action of UV is to alter nucleic acids (genetic information molecules) of the microbes and thereby inhibit important metabolic process, including the ability of the microbes to replicate their nucleic acids and undergo cell division. If UV treatment with a dose of no less than 16 mws-cm$^2$ and preferably above 20 mws-cm$^2$ is used on water of accepted drinking water quality in combination with filtration for surface water sources (to remove the protozoan cysts), and if the fecal coliform standard is consistently achieved, a minimum disinfection level has likely been achieved for most applications.

**Ozonation:**
Ozone is a powerful disinfecting agent that can be used effectively in drinking water applications. The objective when using ozone is to optimize its generation and its contacts with water to achieve the best water quality with the least amount of ozone. Properly applied, ozone is used to oxidize iron bacteria, sulphur and manganese and to devolatize methane, radon and other gases.

The variables determining the effectiveness of ozone in killing bacteria, are contact time and the residual ozone

*Contd. on Page 24*


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- Higher Bacterial count
- Spoils Fasters
- To be processed in Bacterial free air
- To be packed in Sterilized Air
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# Reverse Osmosis Systems

**Water... A Scare Commodity:**
The demand for fresh and hygienically pure water has been ever increasing due to population growth, heavy and unplanned industralisation. The poor management of ground and other water resources, have depleted and diminished the quality of water. These factors force the science and technology to take new measures in treatment of contaminated well waters, polluted rivers, pond waters, and even sea waters.

**The Solution "Membrane Technology":**
The conventional water treatment systems fails to treat brakish and water containing higher dissolved salts / salinity at reasonable operating costs. The state-of-The-membrane technology offers ultimate solution.

Reverse Osmosis is a high pressure (15 kg/sq cm to 60 kg/sq cm,) energy efficient separation process. Low molecular weight organic salts are concentrated while water is allowed to pass. The pore size of 5-20 A° (Angstrom unit) of the membrane retains over 95-99% of the dissolved salts.

This is a process in which water is forced through a semi permeable membrane having a pore size of 0.0001 micron which rejects all undissolved impurities like dirt, dust, bacteria, viruses and also the dissolved impurities like chloride, flouride, lead, pesticides, sodium chloride and various other dissolved ions which cause trouble in industrial, commercial and domestic application of purified water.

Now by using IIECI Desalination plants, based on the Reverse Osmosis principle you can remove more than 98% of total dissolved and undissolved impurities and salinity from brakish or sea water and convert into pure natural water having very low TDS, PH and other specifications as per your requirement for low, medium and very high pressure boiler feed applications, other industrial, commercial and domestic application.

*Indian Ion Exchange & Chemical Industries., D-11, Dimond Park, G.I.D.C. Naroda, Ahmedabad 382325.*

**Application:**
IIECI systems are used to produce water for chemical an textile industries, Ultrapure water for Electronics Pharmaceuticals Industries Food & Beverages, Hospitals Laboratories, Mineral water bottling plants, all potabl purposes, waste water treatment, recycling of effluent wate Biotechnology, Metal finishing etc.

**Range:**
IIECI offers a wide range of standard package plants, ranging from 5 LPH to 5000 LPH for Tap / Brackish / Sea wate desalination application.
IIECI designs tailor made plants as per customer requirement capacity ranging from 1$m^3$/hr to 100 $m^3$/hr.

**IIECI ALSO OFFERS:**
**NANO FILTERATION:**
This is a processing in between UF and RO. The NF membrane preferentially allows monovalent anionic salt like NaCl, CaCl to pass through and retains bivalent anionic salts Na, So, Mg, etc. along with solutes having molecular weights > 300 (lactose, dyes, antibitics) etc.

**Ultra-Filteration**
Ultra-filtration is a low pressure (less than 10kg/sq cm separation process, which allows low molecular weight solutes and dissolved salts to pass through the membrane weigh while solutes (> 1000MW) are retained. The pure size determines the molecular weight cut off (MWCO). This is used in desalting, purification and concentration of enzymes proteins and other higher molecular weight components.

**Micro-Filteration:**
A very low pressure (less than 1 kg/sqcm) process which separates particles above .05 micron from the solvent Typical applications include concentration and clarification o fermentation broths, bacterial filtration, yeast etc.

*Contd. from Page 23*

concentration. The ozone residual is dependent on various factors. Higher levels of oxidisable substances, total dissolved solids and or pH, lowers the solubility. On the other side, lower the temperature of water, the higher is the solubility of ozone. Normally 0.1 to 0.4 p.p.m. of residual ozone level immediately after bottling is maintained in water.

However, interest in ozone as a disinfectant is growing and there are now three basic technologies available to generate ozone. The most widely used methods is electrical (corona) discharge because of the high concentrations of ozone produced relative to the energy applied commonly used methods like, Ultraviolet radiation and electrolysis.

**Remineralisation:**
Generally only major minerals occurring in natural water are added to purified water in "reconstituting" good drinking water. Minerals provide crispness and taste to the water to give wider consumer acceptance. Too high a solid content is not preferred, for this adversely affects taste. On the other hand, purified water is tasteless and therefore not acceptable either by most people. Minerals play very important role in building of body tissues and regulating the body metabolism. Normally following minerals are added:

1. Calcium for improvisation of general muscular activity of heart, burn cholesterol & other fats & puts a break on blood pressure
2. Magnesium protects heart cells during reduced oxyger supply, reduces cholesterol.
3. Sodium & Potassium play key role in preventing cramps & fatigue and to maintain correct water level.

In the remineralisation process, aqueous solutions o these mineral compounds are dosed in the water in desired proportion.

**Distillation:**
Distillation is the process of using evaporation, cooling and condensation to "drive out" water molecules from othe unwanted substances or contaminants.

A heat source causes the water to boil and evaporate The water vapor or steam rises, leaving behind the heavie unwanted contaminants; these do not evaporate but re main at the bottom of the boiling chamber. Then the wate is cooled, usually by contact with a cold tube or coil (a substitute for the cold air in the atmosphere), and the clear water vapor condenses (comes together) into droplets which are caught in the condensation chamber. By causing the water to evaporate from the heavier materials, distilla tion actually removes the water from the other contami nants.

Biological, Inorganic, Organic and Radiologic contami nants are removed by distillation. Some volatile organi compounds (VOCS) have been reported to distill over wit water vapor. In such instances, the installation of a activated carbon prefilter or postfilter with the distiller i recommended.

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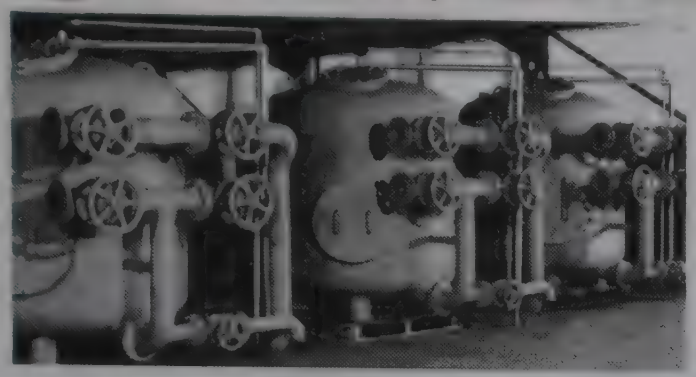

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# Membrane Filitration in the Food Industry

by
**Purnima Srinivasan**

The food industry is an extremely good example for conservation of energy through the use of energy saving separation techniques such as membrane applications. Many of the food materials requiring separation are dilute water-suspensions & water solutions for which membrane separations are particularly suitable energy saving process alternatives.

Membrane technology which is a separation process has unlimited potential in food industries. They include -

| | | |
|---|---|---|
| Micro filtration | - | For clarification in place of centrifugation, sterilization in place of heat |
| Ultra filtration | - | For fractionation, concentration and purification |
| Nano filtration | - | For desalting, de-acidification |
| Electro dialysis | - | For demineralization |
| Reverse Osmosis | - | For concentration, waste treatment |

A membrane is a permeable or semi- permeable phase, polymer, inorganic or metal, which restricts the motion of certain species. The membrane or barrier thus controls the relative transport rates of various species through itself & thus, as with all separations, gives one product depleted in certain components & a second product concentrated in these components. The performance of a membrane is defined in terms of flux or permeation rate, the volumetric (mass or molar) flow rate of fluid passing through the membrane per unit area of membrane per unit time and secondly retention or selectivity, the measure of relative permeation rates of different components through the membrane. Retention is the fraction of solute in the feed retained by the membrane. Ideally a membrane with a high selectivity or retention & with a high flux or permeability is required, although typically, attempts to maximize one factor are compromised by a reduction in the other. Membranes are used for various separations; the separation of mixtures of gases & vapors, miscible liquids and solid/liquid & liquid/liquid dispersions and dissolved solids and solutes from liquids.

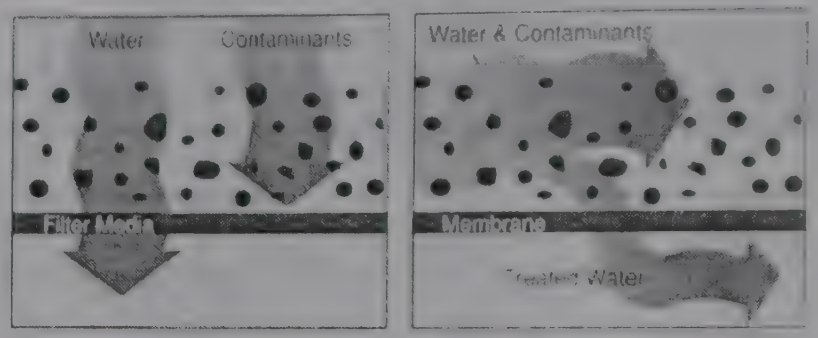
**Filtration Principles**

In normal filtration (left), all water passes through a filter medium.

In crossflow filtration (right), a portion of feedwater is used to carry away contaminants.

**Membrane applications** focus on separating water from contaminants, using semi permeable membranes and applied pressure differentials. In generic terms, they work like window screens that let air but not insects and other larger objects pass through. The smaller the screen holes, the smaller the objects need to be to pass through. Pressure is applied to reverse the natural equilibrium between the clean water and wastewater. The basic principle of natural equilibrium is that the clean water tends to migrate to the wastewater side to equalize the concentrations across the membrane. Mechanical pressure is used to force water molecules from the wastewater side to the clean waterside and, thus, a "high-tech" filtration of the wastewater occurs. In the past, the energy needed to apply the pressure and the fragility of the membrane surface made use of these alternatives economically unjustifiable.

There are varying degrees of membrane filtration. Microfiltration, ultrafiltration (UF), and reverse osmosis (RO) are the current membrane systems used commercially. The filtering capabilities of each (i.e., ability to filter based on contaminant particle size) decreases respectively. Microfiltration is only recommended for removing particles from 0.05 to 2 microns in size, UF is used for particles and suspended solids from 0.005-0.1 microns, and RO is used for particles, suspended solids, and dissolved solids in the Angstrom range (e.g., molecular weight above 200).




Problems with membrane applications include biofouling of the membrane and fragility of the membrane surface. Toxic synthetic compounds can oxidize the surface of the membrane, thus, destroying it. New innovations in membrane technology have advanced the "cleanability" and reuse of membranes. The use of stainless steel and ceramic materials for membranes has greatly improved their use in advanced wastewater treatment.

Studies have shown that membrane applications can be less energy intensive than evaporation and distillation operations and take up less space. The technology gives better control of the process effluent. Unlike chemical precipitation, membrane technology does not produce a sludge disposal problem, but it does produce a concentrated brine solution.

**Membrane Separation and Materials**

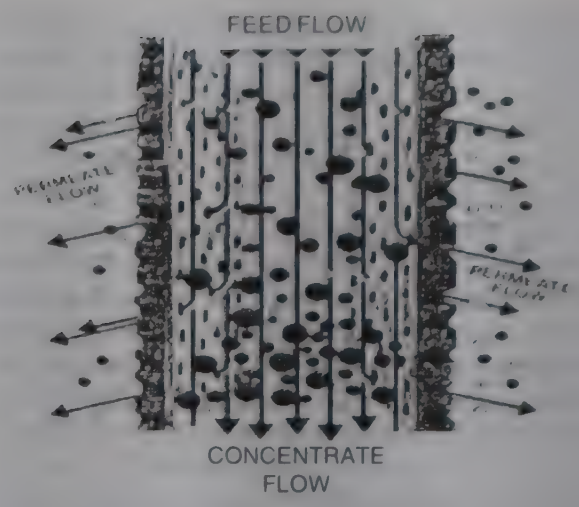
| Membrane separation | Membrane Type | Driving Force | Applications |
|---|---|---|---|
| Micro filtration | Symmetric & asymmetric micro porous | Hydrostatic Pressure | Clarification, sterile filtration |
| Ultra filtration | Asymmetric micro porous | Hydrostatic Pressure | Separation of macromolecular solutions |
| Nano filtration | Asymmetric micro porous | Hydrostatic Pressure | Separation of small organic compounds & selective salts from solutions |
| Reverse Osmosis | Asymmetric with homogenous skin | Hydrostatic Pressure | Separation of micro solutes & salts from solutions |
| Electro-dialysis | Ion exchange, homogenous or micro porous polymer | Electrostatic potential | De-watering of solutionsof suspended solids |

*Food Technologist, Ex- UDCT, Ex-Coca-Cola India - Quality Systems Department*

The above said processes recover valuable components dairy components, fruits, vegetables, grains, sugars, and

**Membrane Technology in the Food Industry**

| Industry | Membrane Filtration | Applications |
|---|---|---|
| Dairy | RO | (Pre)Concentration of milk and whey prior to evaporation |
| | NF | Speciality fluid milk productsPartial demineralization and concentration of whey |
| | UF | Fractionation of milk for cheese mfg. Fractionation of whey for whey protein concentrates. |
| | MF | Speciality fluid milk products Clarification of cheese whey |
| | ED | Defatting and reducing microbial load of milkDemineralization of milk and whey |
| Fruit and vegetables | Juices | Apple (UF,RO), apricot, citrus (MF/UF,RO,ED), cranberry, grape(UF,RO), kiwi, peach (UF, |
| | Pigments | RO) AnthocyaninsApple, |
| | waste water | potato (UF, RO) |
| Animal Products | Gelatin | Concentration and de-ashing |
| | Eggs | (UF)Concentration and reduction |
| | Animal | of glucose (UF,RO)Blood, waste |
| | by-products | water treatment (UF) |
| Beverages | MF/UF | Wine, beer, vinegar - clarification |
| | RO | Low alcohol beer |
| Sugar refining | Beet cane solutions, maple syrup, candy waste waters - clarification(MF/UF), desalting (ED), preconcentration (RO) | |
| Grain Products | Soybean processing | Protein concentrates and isolates (UF)Protein hydrolysates (CMR)Oil degumming and refining (UF,NF)Recovery of soy whey proteins (UF,RO)Wastewater treatment |
| | Corn refining | Steep water concentration (RO) Light-middlings treatment: water recycle (RO)Saccharification of liquefied starch (CMR) Purification of dextrose (MF, UF) Fermentation of glucose to ethanol (CMR)Downstream processing (MR, UF, NR, RO, ED, PV) Wastewater treatment |
| Biotechnology | Production of high quality water (MF, UF, RO, ED) Downstream processing (MF, UF, RO, ED): Cell harvesting, protein fractionation, desalting, concentration | |




Crossflow Filteration

animal products and assist in the purification of many constituents.

The membrane separations being commercially used in the food industry are -

- Maple sap concentration by Reverse Osmosis
- Concentration of sugars from candy rinse waters by reverse osmosis
- Protein concentration from whey, eggs and blood serum by ultra filtration
- Removal of salts from whey by Electro dialysis
- Removal of carbohydrates from apple juice by clarification by ultra filtration
- Reverse osmosis concentration of milk and ultra filtration concentration of milk solids before cheese making

The article would cover the basics of Ultra filtration, Reverse osmosis and Electro dialysis.

Crossflow filtration results in two streams: permeate and concentrate

**Ultra Filtration**

Ultra filtration is a membrane process, which is similar to micro filtration in operation, but which uses asymmetric membranes to carry out 'tighter' filtrations. The process of Ultra filtration is essentially molecular filtration where molecules are separated by their size. The membrane top layer pore size is in the range of 0.05 micro m to 1 nm. The ultra filtration membranes are defined by their Molecular Weight Cut Off (MWCO). An ideal membrane with a MWCO of 1000 would retain all molecules with a molecular weight above 1000 and freely pass through molecules with lower molecular weights. Ultra filtration is a process of separating extremely small particles and dissolved molecules from fluids. The primary basis for separation is molecular size although secondary factors such as molecule shape and charge can play a role. Materials ranging in size from 1000 to 1,000,000 molecular weight are retained by ultra filter membranes while salts & water will pass through. Ultra filter membranes are often operated in a tangential flow made - feed material sweeps tangentially across the upstream surface of the membrane as filtration occurs - thereby maximizing flux rates and filter life. These systems offer the advantage of long life because ultra filter membranes can be repeatedly regenerated with strong cleaning agents.

Ultrafiltration is a form of filtration that uses membranes to preferentially separate different fluids or ions. Ultrafiltration is not as fine a filtration process as nanofiltration, but it also does not require the same energy to perform the separation. Ultrafiltration also uses a membrane that is partially permeable to perform the separation, but the membrane's pores are typically much larger than the membrane pores that are used in nanofiltration.

Due to its separation range, ultrafiltration is applied usually in the food and beverage and pharmaceutical industries. It is usually used e.g. for the retention of the biomass, for the clarification and upgrading of the products. Defined separation limits and gentle working methods are the main advantages of ultrafiltration compared to other separation technologies in these application fields.

A few examples of Ultra filtration in the food industry are discussed below.

**1. Milk fractionation by Ultra filtration**

Milk typically contains 12.5 total solids, 3.3% protein, 3.5% fat, 4.9% lactose and 0.7% ash.

The Ultra filtration of milk retains the protein and fat and certain insoluble & bound salts while the permeate contains lactose and soluble salts. This fractionation of milk typically using polysulfone (or polyether sulfone) type membranes has several applications. These membranes tend to foul more than cellulose based membranes but have higher operating temperature capability (typically temperature between 50-

55° C) and can also tolerate chlorine, used for sanitation and extremes of Ph encountered in preferred cleaning procedures. Concentration polarization is significant in milk ultra filtration and generally high cross flow velocities are used. The maximum total solids, which can be obtained by ultra filtration, is the range 38-42%.

The ultra filtration of milk on farms has been suggested as a means of reducing refrigeration and transport costs. The production of speciality milk based beverages is a potentially large market for the application of Ultra filtration.

In particular, beverages, which have high calcium content but relatively low fat and cholesterol are attractive. The ultra filtration of Skimmed Milk will give a product of higher calcium content as Calcium is mostly present in an insoluble form, bound or associated with casein micelles and a higher protein content. The concentration of lactose and sodium and potassium remains unchanged. To improve the taste of this product, fat (cream) separated(skimmed) from the milk is added.

**2.Cheese manufacture by Ultra filtration**

The manufacture of cheese is a fractional process in which protein (casein) and fat are concentrated in curd and lactose, minerals, soluble proteins and other minor constituents) are formed as whey. Ultra filtration enables production of a pre-cheese by concentration of protein, fat and solids. The pre-cheese is then used to produce cheese by usual methods. There are several cheese products, which can be produced utilizing Ultra filtration and include quarg (unripened, soft, smooth curd cheese, camembert, ricotta, mozzarella and cheddar).

Technical characteristics of Ultra filtered cheese making

**Benefits**

An increase in yield with soft and semi-soft cheese
A reduced enzyme (rennet) requirement
Reduced volume of milk to handle
Very little whey produced
A more uniform product obtained
Ability to use continuous process
Improved sanitation and environmental conditions

**Disadvantages**

Increase efficiency if protein content > 12-14% causing mixing problems with starter culture and rennet
Increased buffer capacity means desired pH may not be reached
Recirculation of concentrate can cause partial homogenization of fat
Semi hard and hard cheeses have a low moisture content

**3. Ultra filtration of whey**

The fractionation of whey by UF to produce protein concentrates has a wide range of applications - Baked custard, biscuits, breads, cakes, chocolate drinks, coffee whitener, ice cream, doughnuts, tortillas, etc.

Ultra filtration can increase the initial protein content from 10-12% (dry basis) to 35%, 50% or 80% protein products with little if any loss in whey protein functionality.

Following UF the components can be fractionated. Following UF the components can be fractionated into lactoglobulin and lactalbumin fractions.

A problem with whey Ultra filtration is fouling of the membrane by protein and salts, with lactalbumin a principal foulant. Polysulfone membranes are more susceptible to fouling than cellulosic membranes.

**4.Fruit Juice processing - Clarification by Ultra filtration**

The use of membranes in fruit juices processing is in three primary areas: clarification using MF or UF, concentration using RO and deacidification using ED.

The production of clear single-strength fruit juices is traditionally carried out batch-wise by a series of filtratio and separations to remove suspended solids, colloids, protei and condensed polyphenols.

The traditional method for clarifying fruit juice is to add fining agent and then either decant the clear juice, or to filt the juice on a precoat filter.

However there are a number of limitations to these method

- Decantation is a slow process that requires large numbers of tanks
- Filter aid leaves a slight after taste in the juice
- The filtration process is costly in terms of labour, energ consumption, enzymes and fining agents

The application of UF as an alternative simplifies th process operation, overall several advantages result -

- A single step process reduces processing time by 2-4 hours
- Increase in juice yield due to elimination of filter acid and fining losses
- Elimination of filter presses and filter aids
- Elimination of fining agents and gelatine
- Improved product quality through reliable and consisten removal of haze forming components
- Reduction in enzyme use

The principal commercial application is the clarification o apple juice, although there are plants operating on citru fruits, such as lime or lemon, pineapple juice, etc. In genera the juice yield is controlled by the concentration factor tha can be achieved in the plant.

In case of apple juice, unless the juice is depectinised, a least partially, the pectins foul the membrane and the rate a which the juice is processed falls off very rapidly. The pectinases can be added to the feed tank of the process and remain within the system during processing. This reduces enzyme usage to a major extent. The UF performance on apple juice depends upon the variety and processing methods With a 25,000 MWCO membrane the tannins remain in the clarified juice importing a brownish color and a sharp flavor With a smaller MWCO (tighter) membrane, the tannins are removed and the clarified juice has light golden color.

**Reverse Osmosis**

In reverse osmosis the membrane pore sizes are of the orde of 0.5 to 1.5 nm and ionic species are generally separated The mode of separation is more complex than that can be explained by molecular size alone. Reverse osmosis i generally used for desalination and the membranes ar defined by their ability to reject salt.

Reverse osmosis is a process to remove low molecula weight solutes e.g. microrganic salts, small organic molecule from a solvent, typically water. The process is sometime also known as hyper filtration. As is evident from the nam RO is the reversal of the natural process of osmosis, by th application of a pressure on the more concentrated solutio in contact with the membrane.

RO is a pressure driven process aimed at the separatio of ionic solutes and macromolecules from aqueous stream The method of dissolved salt removal is different to that of M and is not just a physical process based on size differenc of solute & solvent. Such species are of similar molecul size and of a size comparable to the wide range of po spaces in the polymeric RO membrane.

Reverse osmosis is a process of sending pressuriz water through a membrane, which allows some of the wat to diffuse through as permeate or product water. Althou some of the water passes through the porous membrane, t membrane prevents solids from passing through it, produci two water streams, a product stream and a waste stream I separating the water, the RO process significantly reduc

otal dissolved solids from the drinking or process water, ncluding most unwanted contaminants and chemicals that can affect many food and non-food related applications.

Osmosis occurs when a suitable semi permeable membrane is used to separate two solutions of equal volume, one water and the other a dilute salt solution. Water is transferred from the water side of the membrane to the dilute solution side until an osmotic equilibrium is reached, at which point a hydrostatic pressure, the osmotic pressure, has built up in the solute solution side. By applying a pressure to the salt solution side, the flow of water through the membrane can be arrested and if the pressure exceeds the osmotic pressure the flow is reversed. This is termed RO or hyper filtration in which the concentration of salt is increased by the flow of water (or solvent) from a more concentrated solution to a dilute solution.

RO membranes can essentially separate all solute species, both inorganic and organic from solution. The mechanism of separation of species are based on processes relating to their size and shape, their ionic charge and their interactions with the membrane itself.

The particle size range for applications of RO is approximately 0.0001 to 0.001 micron ( 1 to 10 A) and with solutes of molar masses greater than 300 Dalton, complete separation is achieved. RO has principally a wide range of applications in the processing of aqueous solutions in the following areas:

- Desalination of brackish and sea water
- Purification of pure water for a variety of industries
- Concentration of solutions of food products, pharmaceutical solutions and chemical streams
- Waste water treatment

**Advantages of RO in food processing**

- Lower energy requirement
- Product quality separation without heat damage
- Reduced fresh water requirements
- Reduced waste treatment volume and cost
- Potential increased profit margins from new products
- Relatively low floor space and capital requirement

**Disadvantages of RO in food processing**

- Expense and time to file product safety and obtain approval of new membranes
- Uncertainty of membrane durability and operating life and thus replacement cost
- Questionable chemical inertness and Ph sensitivity
- Limited operating pressure range in some applications
- Fouling with certain feed stocks

**APPLICATIONS OF RO IN THE FOOD INDUSTRY**

**Dairy Industry**

There are several applications of RO in the dairy industry; water treatment, fractionation, product and chemical recovery, and concentration and denaturing. The concentration of process streams to achieve reduction in Total Solids to incur a lower cost than by evaporation. Also there is a considerable reduction in volatile flavor component losses and in adverse changes to heat sensitive components. RO also reduces discharge volumes to water treatment facilities and produces reusable water.

The commercial applications of RO in the dairy industry include cheese whey concentration, concentration of whey and milk, desalting of salt whey, and treatment of water, waste treatment and UF permeates of whey and milk. The RO membranes are made of cellulose acetate and Polyamide.

**Grain Milling**

The RO applications include BOD reduction, wastewater recovery and reuse and recovery of by-products from wastewater

**Beverage**

The RO applications include Cold stabilization of beer, removal of color from wine and removal of alcohol from beer and wine

**Fats and Oils**

The RO applications include Wastewater treatment

**Sugar Industry**

The RO applications include preconcentration of dilute sugar solutions, maple syrup and recovery of sugar from rinse water

**Fruits and Vegetables**

The RO applications include concentration of tomato juice, wastewater treatment, concentrated juices and juice flavor and aroma concentration.

The traditional method used to concentrate juices and purees has been evaporation and the competing membrane technology is reverse osmosis. Although evaporator designs have improved giving lower energy consumption and reduced operating costs, there are still several advantages associated with RO -

*Contd. on Page 30*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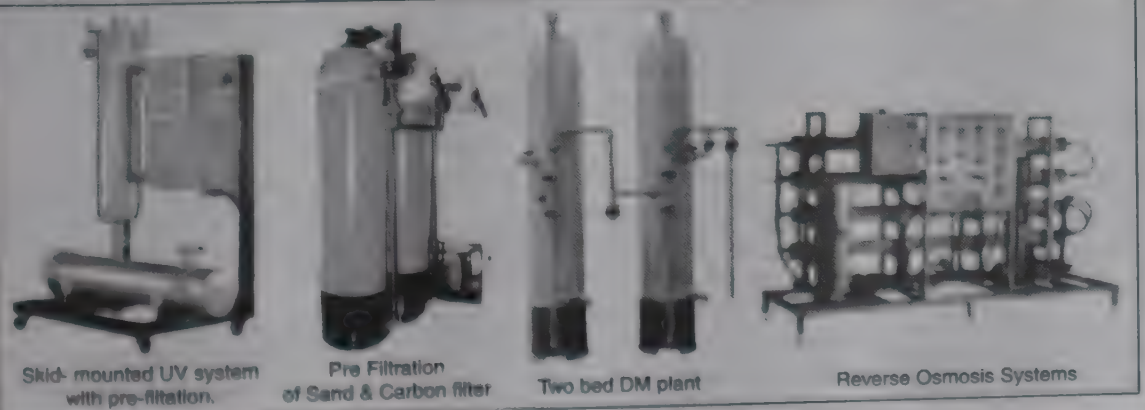

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# Water Is An Industrial Filter

by
**N.R. Mhatre**

The basic function of a filter or a strainer is to arrest foreign particles from the fluid, before these can cause damage to costly equipment like Lubricating Equipment, Pumps, Bearings, Burners, Nozzles, Coolant Systems, etc. The difference between a Filter and a Strainer, as a thumb rule, is that generally the Strainer is a coarse Filter. The Strainer removes the particles, which are visible to the naked eye. The Filter on the other hand removes particles which are not visible to the naked eye (particles smaller than 75 microns).

This is the reason as to why, depending upon the need, Strainers are also used in series with the Filters, obviously ahead of Filters, so that comparatively larger or heavier particles are initially arrested by the Strainers, thereby reducing the frequency of replacing the Filter Element.

The design of Filters or Strainers is tailor made to suit the requirements of the customer. Normally the following parameters are required to be provided to the designer and manufacturer of filters.

- The fluid to be handled viz. Water, Oil, Salty Water, Contaminated Water, Acid, Chemicals, Fertilizers, Food, Air, Gas, Steam, Paper Pulp etc.
- Working Pressure
- Flow Rate.
- Degree of Filtration
- Operation, whether Manual of Motorised.
- End Connection desired.
- Working Temperature
- Viscosity
- Frequency of Cleaning.
- Permissible Pressure Drop.
- Working Condition at sites

Filters or Strainers may be associated with followin accessories:-

- Jacketted Design.
- Davit Arrangement.
- Control Panel
- Differential Switch.
- Vent Valves.
- Electric Actuator
- Pneumatic Operation.
- Quick Opening Arrangement
- Motorised Operation.
- Differential Pressure Gauge
- Drain Valves.
- Bypass Valve
- Hydraulic Cylinder.
- Magnetic Inserts.

As such the filtration range is a very wide and diverse field Nevertheless the main types of filters can be generall classified as Basket Filters, Duplex Basket Filters, Se Cleaning Filters, Air Filters, Lube Oil Filters, High Pressur Filters, Separators, Pressure Sand Filters, Cartridge Filters Bag Filters, etc.

*Filteration Engineers (I) Pvt. Ltd., Mumbai*

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***Contd. from Page 29***

- Improved products quality in terms of flavor and color
- Lower capital and operating costs
- Expansion of capacity to preconcentrate upstream of an existing evaporator

RO is an attractive method wherein the benefits are -

- Recovery of valuable fruit solids
- Reduction of BOD in waste streams with reduction in sewerage charges
- Provides high quality water which can be re-used as CIP water, boiler feed water after treatment
- Reduced running costs compared to evaporation

**Desalination - Water Treatment**

One of the most widely used membrane processes is desalination of seawater for potable use. RO is the most energy efficient process for water desalination. Cellulose acetate and polyamide membranes in spiral and hollow configurations are generally used. Seawater contains about 3.5% salts and has an osmotic pressure of about 350 psi. Therefore the pressure requirements in desalination are of the order of 500-600 psi.

One of the major goals of research is to develop membranes so that the operating pressure used in desalination plants can be reduced significantly. Only about 50% of potable water is claimed by desalination. The economics lies in the fact that seawater is readily available, the concentrate containing salts is readily disposed off back into the sea and potable water is otherwise not expensive.

The same process can be used for treatment of waste water or brackish water, also for treatment of boiler feed water.

**Electrodialysis**

Separation in Electrodialysis is based on the net charges of the molecules to be separated. Negatively charged molecules are repelled by a negatively charged membrane, but readily permeate through a positively charged membrane and vice versa. The driving force in ED is direct electric current. The pore sizes in ED Membranes are of the order of 1 nm. ED i used for the separation of organic acids, amino acids an other charged small molecules.

Membrane processes in general play a significant role i the food industry and in particular the dairy industry. ED i used to de-ionise or de-acidify fruit juices, wines, milk an whey. Desalting of molasses in the production of sugar is a economically attractive process.

The scale of operation of ED in the dairy industry is sma compared to desalination although the value of the product i these applications is usually greater. The desalting of whe is the largest use for ED in the food industry.

**Grape musts and wine**

The precipitation of tartrates from grape musts and wines i a common phenomenon in the evolution of a wine. It i caused by the insolubilisation of the salts of the tartaric aci naturally present in the must. ED can be used to extract th excess of these salts from musts and wines. ED can also b use in wine production to harmonise the wine by adjusting th ratio between sugar and acid.

**Conclusion**

A promising future is anticipated for membrane processe especially value added and heat sensitive products. Wit advances in biotechnology in the food and drug industrie the use of membranes would increase.

The limiting factors in membrane processing is the lack availability of membranes for specific product recovery Th commercially available membranes are suitable for gener application where separation is based on molecular size

In India membrane technology is promising for productio of potable water from brackish water or seawater, in th nuclear industry for fuel enrichment and waste treatment, i chemicals and petrochemicals, medicine, biotechnology an the food industry.

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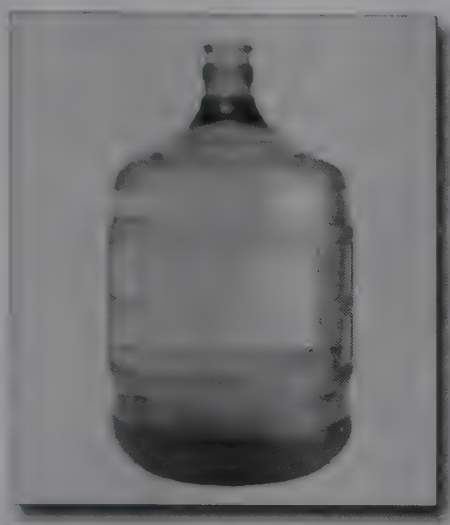

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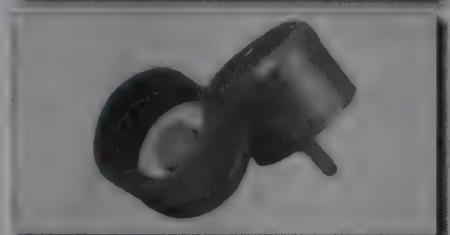

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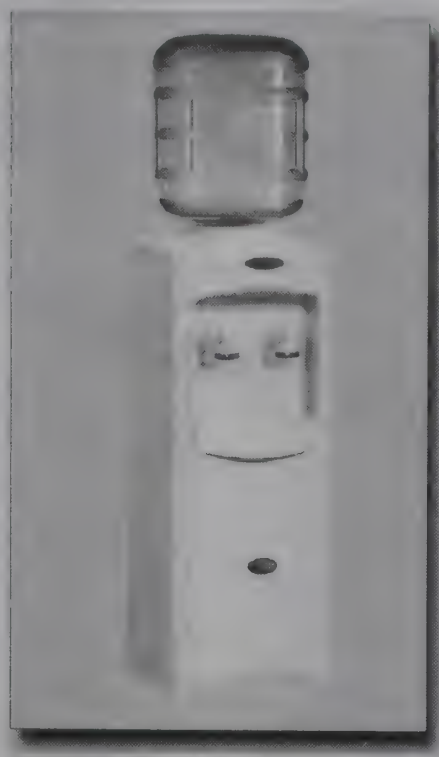

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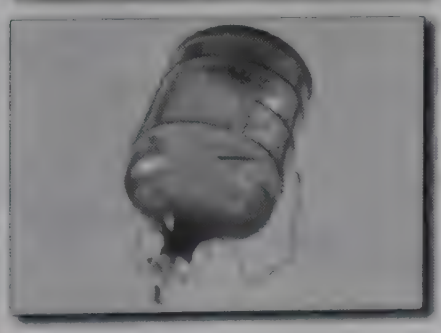

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# Ozone in Food Processing Applications

by
Dr. Subodh Bhatnagar

*Abstract*

***The recent stories of food contamination reported in the media serve to highlight the need for the food industry in the U.S. and in India to seek better, more effective methods of ensuring the safety of food products. In the vast majority of cases reported, the culprits have been identified as Escherichia coli, Salmonella enteriditis, Listeria monocytogenes and other pathogens found in fruits, meats, shell fish and other foods consumed by the public. The results of these cases of contamination have been serious illnesses and, in some cases, fatalities.***

The use of ozone in the processing of foods has recently come to the forefront as a result of the recent declaration by the U.S. Food and Drug Administration granting. Generally Regarded as Safe (GRAS) status. The FDA grant of approval marks a watershed event for the food industry. Prior to the declaration, FDA has approved Ozone for use only as a Disinfection mechanism for bottled water production and the sterilization of bottled water lines. The recent regulatory breakthrough is a result of efforts made by the Electric Power Research Institute (EPRI) and the panel of technical experts assembled to review and evaluated the efficacy and safety of ozone in food processing. The panel's report has been published and is filed with the FDA.

It is worthy to note that, the use of Ozone in food processing has been allowed and accepted in Japan, Australia, France and other countries for some time. There is a plethora of documentation and supporting literature attesting to the benefits of Ozonation as a food product sterilization methodology some of which will be reviewed herein.

The FDA's recent declaration serves to provide the basis for expanded use of Ozone in food processing with application ranging from produce washing to recycling of poultry wash water to seafood sterilization. A sampling of these applications will be presented in the attached case studies.

**The 1997 EPRI Expert Panel Report**

The document is organized as follows: An Executive Summary that is followed by chapters dealing with Efficacy of Ozone, Applications of Ozone, Safety Issues and Ozone Toxicology, Nutrient Impact of Ozone and Summary Options of the Expert Panel. Also within the EPRI document are various appendices containing the qualifications of the experts, abstracts and citations of pertinent articles dealing with the use of ozone in processing and preserving foods. Specific applications are divided into 37 categories including; treatment, disinfection, eggs, fish, fruits, meats, poultry, vegetables, storage.

**Introduction**

Ozone, first discovered in 1840 (Schonbein), is being utilized as a disinfection agent in the production of potable water in France in the early 1990's. The majority of early development was limited to Europe where it became more widely used in drinking water treatment. The potential utility of Ozone to the food industry lies in the fact that Ozone is 52% stronger than Chlorine and has been shown to be effective over a much wider spectrum of microorganism than Chlorine and other disinfectants. Complementing the effectiveness, is the fact that Ozone, unlike other disinfectants, leaves no chemical residue and degrades to molecular oxygen upon reaction or natural degradation. The fact that ozone has a relatively short half-life is both an asset and a liability to practitioners. This is particularly true in the treatment of drinking water where ozonation is employed to enhance filtration and provide primary disinfection but requires the addition of Chlorine as the terminal disinfectant to maintain a residual in the distribution systems.

Ozone is the effective in killing microorganisms through oxidation of their cell membranes and most of the pathogenic, foodborne microbes are susceptible to this oxidation effect. During food processing operations, surface disinfection of the product (raw or partially processed) is very important. This is supported by the following statistics:

1. An estimated 30% of fresh produce is lost by microbial spoilage from the time of harvest, through handling, storage, processing, transportation, shelving and delivery to the consumer (Beuchat 1991).
2. The USDA estimated the costs associated with foodborne illness to be in the range of $5.5 billion to $ 22 billion per year.

**History of Early Ozone Applications in Food Processing:**

Some early reported uses of Ozone in food processing and preservation have been reported and documented. The examples below represent a sampling of notable cases:

**1. Fish and Shellfish Preservation**

Washing of fish with ozonated water extended shelf life for 5 days:

Experiments performed by Violle in 1929 found that seawater spiked with various strains of bacteria (B. *typhus*, B.*coli*, etc.) resulted in sterilization that was comparable to what was obtained in fresh water. Further experiments showed that exposure of shellfish to ozonated water did not adversely affect the taste or appearance of the shellfish. Thus, Violle concluded that preozonation of water was suitable treatment for depurations of shellfish Later work by Salmon and Le Gall (1936) built upon the work of Violle and reported that fresh fish, stored under ozonated ice (presumably hypochlorous acid treated) which were previously inedible after the 8th day, remained fresh till the 12th day.

The original work in this area was carried further by others and reportedly resulted in the installation of an ozone systems designed to sterilize 2000 kg per day in Le Havre, France and another facility in Boulogne-sur-Mer for treating a daily output of 6000 kg.

**2. Ozone Used in Cold Storage for Meats:**

Gaseous Ozone was used as a preservation agent in meat and egg storage:

Kuprianoff (1953) reported that the first known use of ozone as a food preservation agent was in Cologne, Germany dating back to 1909. Later industrial applications using gas phase ozone for food preservation were reported in 1924 where Hartman stated that *"in cold storage, ozone is successfully used to prevent the growth of fungi" and "eggs have been carried at a relative humidity of 88 and 90 percent and mold development inhibited with the use of*

*Creative Concepts, F-60, Sector 8, Noida - 201 301 (U.P.)*

*ozone"*. Hartman summarized by noting that ozone *"has manifold applications in cold storage and splendid results are being obtained in practise with this reagent every day"*.

**3. Disinfection and Preservation of Fruits and Vegetables:**
One of the earliest reported experiments dealing with preservation of fruits was related to ozonation of bananas (Gane - 1933, 1934, 1935, 1936). Since then numerous studies have been conducted on a wide variety of fruits and vegetables including carrots, broccoli, pears, peaches and apples. The vast majority of these studies have reported some degree of shelf life extension and reduction of pathogenic contamination.

**Recent Studies of Ozonation in Food Processing:**
In India ozonation of water for disinfection is a proven area, however, application of ozone for food processing is still in its infancy and an upcoming field. Inspite of the regulatory roadblocks limiting usage of ozone in the U.S. food processing industry, numerous studies were undertaken to determine the efficacy and economics of ozonation. The examples below serve to illustrate some of these studies and conclusions.

**1. Fruits and Vegetables:**
Several controlled studies have been reported in food science literature relating to the evaluation of treatment of fruits and vegetables with ozonated water. Kondo ***et al*** (1989) observed greater than 90% reduction of total bacterial counts upon treatment of Chinese cabbages with ozonated water (2.3mg/l) for 60 minutes.

Treatment of wash water used in processing of carrots has been reported to provide 3 log reduction of bacteria (Williams ***et al*** 1995).

Barth ***et al*** (1995) evaluated Ozone exposure for prevention of fungal decay on thornless blackberries. The fruit was harvested and stored for 12 days at 2 deg. C and 0.05, 0.1 and 0.3 ppm Ozone, then evaluated for fungal decay (*Botrytis cinerea*), anthocyanines, colour and peroxide activity. Ozone storage suppressed fungal development for 12 days, while 20% of control fruits showed decay. The treated fruit did not show observable injury or defects.

Sarig ***et al*** (1996) showed that Ozone at low dosages (0.1 mg/g fruit) for 20 minutes, reduced the levels of fungi yeasts and bacteria on grapes, but that at higher doses caused some fruit damage.

**2. Poultry:**
The poultry processing industry is a large volume consumer of water. The potential for reuse of poultry processing water represents an attractive economic benefit to the industry. In 1996 the USDA approved the use of ozonation for washing of poultry carcasses (provided that the ozone did not come into direct contract with the product). Studies by Chang and Sheldon (1989) reported that a combination of screening, diatomaceous earth filtration and ozonation yielded the highest quality of water with total microbial loads (total coliform, E-*coli* and *salmonella* reduced by 99%). A subsequent study, Chang and Sheldon (1989) found no significant differences in measures of carcass quality including skin color, taste of shelf life using recycled, ozone treated water as opposed to fresh makeup water. The investigation further reported that a 2.7 log in of total plate count was observed in the recycled water stream. The results of this study showed that, for a typical broiler processing plant (240,00 broilers/day) the savings resulting from chiller water reuse would equate to 50% reduction in discharges and savings of more than $45,000 per year.

**3. Extension of Food Products Storage Life:**
The following are a sampling of studies directed at application of gaseous Ozone in food storage facilities.

A 1980 study (Gabriel'yants') showed that cheese stored with periodic ozonation prevented mold growth for 4 months while controls showed mold growth as soon as 1 month.

A Japanese researcher indicated good results in the treatment of grains, flour and raw noodles with Ozone with significant reduction in microbial growth.

Dondo ***et al*** (1992) reported that Ozone treatment during refrigerated storage stabilized the surface bacteria count on beef and reduced that on fish. Naitoh (1989) showed that ozone treatment inside a confectionery factory reduced airborne microorganisms over a 1 to 1.5 year period. "remarkably" inhibited bacterial growth and extended storage life of the products by 7 days.

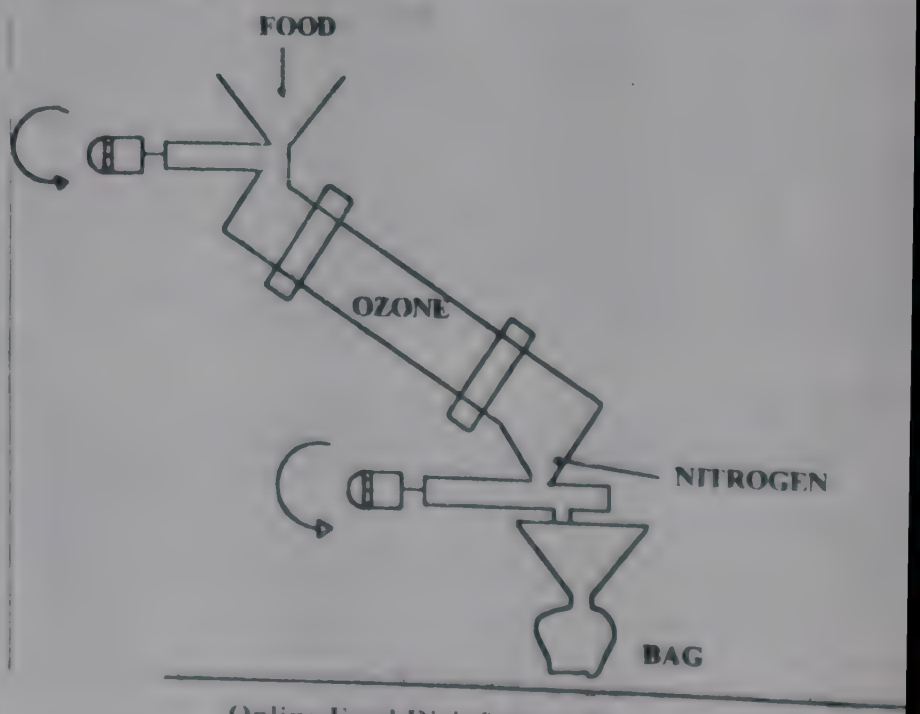
## DISINFECTION OF FOOD ITEMS

**Need for Disinfection**
Several food items before packing for dispatches and exports are required to be totally disinfected and should have low bacterial load as per the laid down standards. This is essential to preserve freshness and increased shelf life of the product.

**Present Practice and Problem**
The food items are washed by chemicals added into the water or being processed in a most hygienic environment. Even in these conditions, in some cases, the bacterial load is higher than the stipulated limits. Food items are required to be disinfected at this stage or otherwise the whole lot will get rejected.

**Improved Disinfection Method**
Ozone, is a very strong oxidizer and a powerful disinfecting substance. Food items can be exposed to a low Ozone concentration during processing & packing. This will reduce bacterial load and thus increase freshness and enhances shelf life.

**What is Ozone**
Ozone, triatomic oxygen, is colourless gas with a acrid odour. It is very reactive and the strongest commercially available disinfectant and decomposes back to oxygen, this makes it the preferred choice for disinfection of process water and major contribution, towards cleaner environment.



Online Food Disinfection Systems

**How Ozone is Produced**
Ozone is produced by passing dry air between two concentric electrodes where a high voltage is applied. A small amount of Oxygen of the air is converted into Ozone and used for disinfection of food items and for process water treatment.

**How Disinfection Takes Place by Ozone**
Ozone is the most efficient broad spectrum microbiological control substance and a very reactive disinfecting agent. It destroys all bacterial, viruses and cysts in a very short duration when it comes into contact with food items and in water. Ozone is considered by most to be the best available natural technology and a much better alternative than using chemicals.

**Ozone is gm/hr. Required to be Dosed for Food Disinfection**
Amount of Ozone depends upon the level of infection, temperature, the rate of production to be disinfected, criticallity and the method of application and is calculated on case to case basis.

**Ozone Concentration to be Maintained in the Treatment of Food Items**
In case the food items are required to be disinfected in the open environment, the concentration of Ozone can not be increased more than 0.1 ppm which is the limit in presence of working personnel. However, if food items are to be treated in a closed chamber, the concentration can be higher and upto several ppm.

The exposure to Ozone will make the food items totally bacteria free and well within the limits laid down by FPA.

**Limit of Ozone Concentration**
Ozone Concentration should not exceed more than 0.1 PPM where operating persons are present.

**Method of Sterilization**
The method of sterilization depends upon the type of food items. Several contract methods are utilized and these are Tumbler Drum, Rotary Drum, Screw Feeder and disinfection during pneumatic transportation.

The system designed needs input like type of food items criticallity of disinfection, actual bacterial load requirements and rate of production.

**Monitoring and Control of Ozone**
The concentration of Ozone environment for food disinfection is monitoried continuously by using an Ozone Monitor for indicated and control of Ozone Concentration.

The monitoring system can be equipped with a high level alarm and can give a warning in case of lower concentration.

---

## OZONE FOR DISINFECTION OF PROCESS WATER IN FOOD PROCESSING INDUSTRY

**Need of Disinfection**
The process water is used for washing, cleaning of the raw material and the processing equipment. Thus the process water should be free from any bacteria, yeast, moulds or any viruses for production of quality products.

**Present Practice**
The raw material and the equipment is washed and cleaned by chlorinated water or other chemicals which leaves harmful compounds e.g. Chloramines & Trihalomethanes etc. the use of chemicals is also banned and being phased out fast.

**Improved Disinfection Method**
Ozone a very strong oxidizer has powerful disinfecting properties. A very small concentration of Ozone in water makes it free from bacteria and virus, much faster and with lesser concentration in a most effective manner.

**Ozone (in gm/hr.) Required to be Dosed in Process Water**
The amount of Ozone depends on composition of water, method of application, temperature and presence of bacterial load. As a thumb rule, 1.0 to 2.0 gm/hr. Ozone is needed for a flow rate of 1,000 lit/hr.

**Ozone Concentration to be Maintained in the Treatment Water**
A very small Ozone concentration of 0.05 to 0.2 PPM is adequate for making process water free from bacteria and viruses. The actual concentration required to be maintained depends upon the criticallity of application.

**Method of Water Disinfection**
Ozone is brought in contact with water by following methods.

- Diffusing Ozone into a single or multiple water columns.
- On Line Injection using Ventury
- Injecting Ozone into re-circulation line in a water storage tank and supplying water from this tank.

**Monitoring and Control of Ozone**
The concentration of Ozone in water should be continuously monitored and controlled by using an ORP Sensor and Controller System for indication and control of Ozone Concentration in the process water.
The monitoring system can be equipped with a low level alarm and can give a correction signal in case the concentration is lower than the set point.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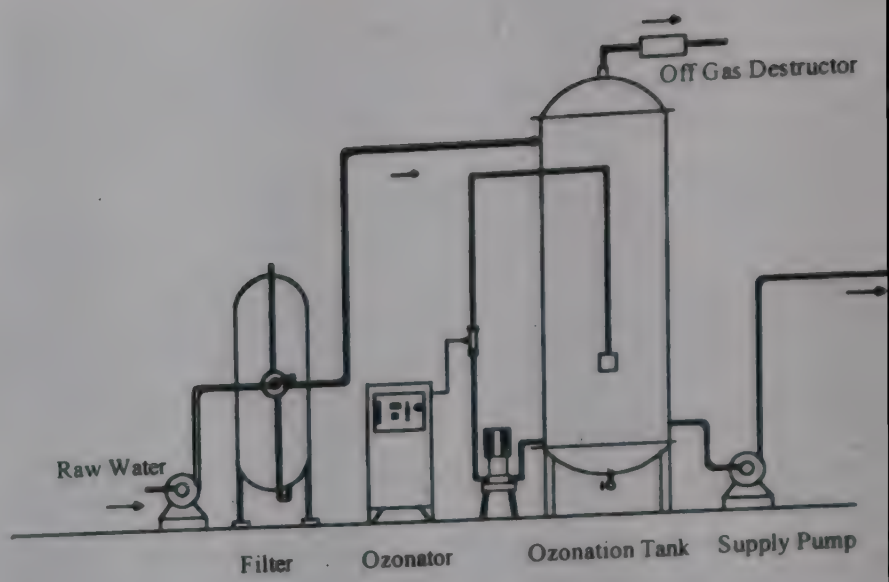
**4. Ozone Treatment of Dye Wastewater**
Several studies have shown Ozone and Ozone/hydrogen peroxide to be effective in removal of color resulting from dye processing. Dyes used in food processing are typically easier to oxidize with Ozone since they are organically based compounds.

**Discussion of Current and Future Applications**
Ozone is by no stretch a panacea or universal solution for all food processing operations. There are a significant number of good, sound, application including; disinfection of food wash water, wastewater treatment and recycling, treatment of cooling water and process water, and gas phase sterilization of products in storage and transport. Along with these beneficial applications comes some limitations. There are existing restrictions relating to human exposure to ozone (OSHA and EPA) which must be considered. Plant operators seeking to employ Ozone will be faced with system design and process operation challenges.

Proliferation of Ozone applications in the food industry is assured. As of this writing, the industry is free to start using Ozone. Operators wishing to apply Ozone are expected to employ Good Manufacturing Practices to protect workers from inadvertent exposure to Ozone as well as to avoid overdose of Ozone which may cause damage to the food product. Users may notify the regulatory agency that they have determined that the use of Ozone for the intended purpose is GRAS (explaining the proposed application, the conditions for intended use, and the basis upon




**Ozonator Water System For Food Processing Plant**

which the GRAS determined has been made) and begin employing ozone immediately and market the ozone treated products. Such users should realize that the they now bear the responsibility for the GRAS determination.

**Conclusions**
As a result of the recent FDA ruling and same may be followed in India, it is anticipated that ozone in food processing will be accelerated due to a number of factors:

1. The use of Chlorine by the food industry is coming under increasing scrutiny by regulators due to toxicity issues and disinfection by-products (DBPs).
2. Ozone has been proven to produce greater lethality rates for microorganisms than chlorine or other chemical sanitizing agents.
3. The recent surface water rules promulgated by the U.S. EPA and Pollution board of India relating to Chlorine and Chlorine derived DBPs will undoubtedly stimulate operators to seek technologies which will assure discharge compliance.
4. The increasing cost of water resources (both makeup and discharge), together with the drive toward more conservation, will stimulate industry to seek treatment methods which allow recycling of product wash water and process water.
5. Advances in Ozone generation and applications technologies have continued to make the process more reliable and economical.

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## ERRATA

Due to over sight the author's name in Article titled **"CAB-O-SIL (M-5), Fumed Silica as a conditioning agent for the food processing industry"** published on Page 39 in the May 2001 issue of Beverage & Food World was ommited The article was submitted by Jay Chem Marketing, B/5, 3rd Flr., Nemi Krishna Society, Vasanji Lalji Road, Kandivili (W), Mumbai 400 067. Tel: 8020141 • Telefax: 8061337 • Email: jaychem@bom3.vsnl.net.in who are (Authorised Distributors of Cab-O-Sil (M-5), Fumed Silica manufactured in India for the first time by Cabot Sanmar Ltd., in techno commercial collaboration with Cabot Corpotation, U.S.A. The error is regretted.

# Separating Solids from Solution

by
**Birger Nordmark**

Filtration operations are important processes in the food industry. In a broad sense, filteration is one of several methods of separating solid matter from solutions. It is the primary technique for removing suspended particles from a fluid mixture, which may be either liquid or gaseous. Industrial applications of the two are sufficiently dissimilar to form separate engineering disciplines. Thus, this article will deal with filteration of liquids only.

Filteration is a generic term for several methods known by various names depending on the mass and particle size of the suspended matter, like draining, sieving, straining, clarification, or polishing.

In a filtering process, the liquid to be filtered (the feed) is made to flow through a membrane of some kind (the filter medium) where the suspended particles are arrested to let the filtered liquid (the filtrate) pass through.

Filteration and filters can be classified in several ways, for example according to driving force, filtration mechanism, function, operating cycle, or the nature of the solids.

The force that induces the feed to enter the filter medium may be due to gravity or to pump generated hydrostatic pressure upstream or to partial vacuum downstream or to centrifugal force across the membrane. Most filtrations represent one or the other of two mechanism. In the one case the solids are stopped on the surface of the filter medium and form a cake, in the other case the particles are trapped within the pores of the filter medium. Filters performing according to this latter mechanism are often called clarifying filters.

The function of a filtration process may be to harvest either the filter cake or the filtrate or both, depending on the value of the different fractions. Filters may be operated batch wise or continuously. Batch filters may be operated with constant-pressure driving force, at constant rate, or at cycles that are variable with respect to both pressure and rate.

In the case of cake filtration the nature of the solids will determine whether the cake is compressible or not. This in turn will depend mainly on whether the particles are rigid or deformable.

Variants of cake filtration have important applications in major food processes. The sugar industries employ closed filter to remove impurities from sugar solutions before concentration and crystallisation. The dairy industry employs open screen filters for harvesting milk protein curd after precipitation. A related mechanism is followed in the micro and ultra filtration methods, where the value of the solids may be dominant, but the solids leave the filter as a concentrated fluid rather than as a 'cake'.

As for number of installations in the food industry clarifying filters would dominate. They are used for cleaning and deodourising, even sterilising water for use as product ingredient or for washing and rinsing equipment. To some extent they are also used for clarifying stream of wastewater.

**Filter Media**

Filter media used in industrial filtration processes may be classified in four general types:

- Woven cloth filters and wire mesh, or felted sheets of wood cellulose or textile fibres;
- Granular filters such as sand or crushed charcoal;
- Rigid, porous filters formed by firing ceramic clay mixtures at a low temperature;
- Filters composed of semi-permeable or penetrable membranes of synthetic polymers. For special applications, membranes of animal origin may be used.

Woven filter cloth of cotton or synthetic fibre would be the most common medium for cake filtration, whereas the other types find use in various clarification applications.

Sand filters are probably unequalled in performance and economy for the removal of heavy loads of impurities from large volumes of water. In-line filters using all types of filter media have seen a great development in recent years.

Activated carbon is a filter medium that stands out on its own. Besides trapping particulate matter in its pores, it adsorbs molecules of colouring and odorous substances on its vast internal surface. Decolourising carbon is made from soft raw materials like saw dust or lignite, while odour adsorbing grades are made from harder materials like coconut shells, fruit pips, or briquetted coal and charcoal. The specific internal surface area is, however, the most significant characteristic. It is reported to vary between 300 to 2500 square metres per gram. For liquid filtration use, activated carbon is supplied in powder form.

Activated carbon filters are made in versions varying from large units for decolouring process solution in sugar refineries to small under-the-sink household units for removing the odours of chlorine and organo-chlorine reaction products from domestic tap water.

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# Selection of Valves for Different Services

There are an almost infinite number of fluids that can pass through a valve as any set of corrosion charts will demonstrate. But simply determining whether a body material is acceptable for a given service is nowhere near all that is required. Not only do all the components that come into contact with the process (known as wetted parts) need to be considered, but the combination of materials are sometimes important. In many cases the material and design of nonwetted parts are significant. In some situations, such as offshore, underground, or in large chemical plants, the external of valves may be exposed to as much or more chemical action that the internals.

Many other factors must be considered. Temperature is almost always significant, not only in how the corrosion rates are affected by the fluid temperature, but in how the material itself is affected by temperature, through allowable stress levels or notch toughness or many other mechanical properties choices, and on whether a given material is even feasible. Adding an additional dimension to all the other factors is cost. Many material and designs are possible, but infeasible or a less desirable choice because of cost.

**Coking or Heavy Oil**

These services are generally hot, by nature of the processing they undergo and, if for no other reason, because their pour points are so high. Piping is either carbon steel or chrome steel, depending on temperature. Corrosion allowances range from 1/16 to 3/16 inch (1.6 to 5mm), but sometimes it is cheaper to change metaliurgy to a more corrosion-resistant chrome steel than to add extra wall thickness required for the corrosion allowance. Because of the viscosity and the necessity for clean out if the oil sets up, the minimum size for drain valves is generally 1-1/2 inch (DN 18). Other block valves are standard flanged or socket weld. For coking services, sometimes purge ports are provided on gate valves for injection of flushing oil to help clear deposits prior to operating the value.

**Lube or Seal Oil**

The requirement is for cleanliness or for the elimination of particles that the oil could pick up and carry into machinery bearings. Stainless steel is often used, since after assembly only a flushing of the lines is required. Flanged carbon steel valves are often used with the stainless steel piping since they can be inspected for cleanliness before installation. Carbon steel piping can be used, but it requires a chemical cleaning to remove the scale and rust, which may make it more expensive than stainless steel in terms of installed cost.

**Hydrocarbons (General)**

As used in processing plants, carbon steel, piping with gate valves is acceptable for the majority of services regardless of molecular weight. However, much processing is done at elevated temperatures, which simultaneously lowers the strength of the pipe material and (often) increase the corrosivity or reactivity or permeability of the fluid. For oils that contain any substantial sulphur, at about 599°F (260°C) and above the preferred material is a chrome steel. At temperature of 800°F (425°C) and over, the preferred material is 9 chrome 1 moly. For processing at temperature of 900°F (480°C) and higher, an austenitic stainless steel is normally required, sometimes 316 stainless but more often a stabilised grade like 347 stainless. For hydrogen services, a similar progression occurs but it is more formally described in the Nelson curve (API RP 9421). For noncorrosive processes at high temperature, carbon ste is adequate to about 750°F (400°C) long term and 850 (450°C) for short term use. Chrome steels are good to 1,0 to 1.100°F (535 to 593°C) depending on the grade; a stainless steels, preferably high carbon grades like 340 are good to about 1,200°F (650°C). Above that temperatu the Inconels and Incoloys can be used up to arou 1,500°F (815°C). Very few process have even been intende to operate beyond that point, although some exotherm reactions can reach 1,800°F (1,000°C) in a runaway cas Where such conditions occur, the normal recourse is t use of refractory linings.

**High Pressure Steam**

Steam systems of 600 psi (40 bar) and above are usua considered high pressure. Carbon steel is acceptable f class 600 (PN 40) systems, depending on the degree superheat present. The temperature limit for carbon ste is usually considered to be 400°C for steam. Conditi slightly greater than that call for 1-1/4 chrome, 1/2 mo and conditions in excess of 480°C usually use 2-1 chrome, 1 moly because of its greater strength temperature. Very hot high pressure steam services central stations may use an austenitic stainless usua 316 but sometimes 347 to other, for temperature up 650°C and pressure up to and beyond the critical poi (3,206 psi) (225.7 bar). Valves for 600psi steam syster is normally butt-weld end. In plant steam systems bolte bonnet valve are used. Pressure seal bonnet designs ca be used, but their real advantages over bolted bonn designs are in class 900.

**Solid Catalyst**

Catalysts are usually transported either suspended in air in a liquid slurry. Depending on the hardness of the cataly and whether there is any process fluid present (cataly withdrawal lines), the piping can be aluminium, steel, stainless steel. Valves are often knife gates, sometim with hard faced edges and air or steam ports to blow t catalyst away from the seating surfaces as the valve closed. Another common choice is a full port ball valv usually a high performance type with hard coatings, su as chromium carbide or tungsten carbide. For ha catalysts, sometimes a rubber lining is used.

**Solid Plastics**

Many solid materials can be conveyed in air. Pipi designed for conveying normally has large radius bend often ten diameters or more, and may require a specia roughened interior surface so that the pellets bounce instead of wiping along the surface and forming streame Often the piping is aluminium, usually with rod-ty couplings rather than welded constructions. Valves a special designs, such as knife gates, pinch valves, diver valves, almost always flanged. If small drain or pur valves occur, they are sometimes threaded stainless.

**Molten Polymers**

Many polymers and heavy compounds are formed reactions at somewhat elevated temperature, 100 to 200 and either after formation or during further processing a often conveyed in a molten state. The viscosity of the polymers is very high and they solidify very easily, requi constant heat input over virtually every square inch piping surface. If only moderate heat input is required tracing system can be used, either electric tracing, wh uses resistance wire wrapped around the pipe, or ste

racing which uses tubing wrapped around the pipe. The nsulation is then applied over the heat sources. If more eat input is needed, the usual recourse is to jacket the nes so that the process piping is completely surrounded y steam. Valves are sometimes wrapped with tracing, or hey may have special clamp-on aluminium jackets with team chambers inside, where the aluminium acts as a eat transfer medium, or they may be fitted with welded-on acket, which are the most expensive but the most effective. Sometimes standard flanges are adequate, but if a very horough heat coverage is needed, the flanges are oversized so that the jacketing can be brought up to the very edges of the flanges.

Valves used in paint services, like spray booths, can be conventional design except that they must be assembled dry without lubricant. Ball valves are the normal choice.

**Polyethylene**

Other polyethylene plants used a high pressure reaction operating at 30,000 to 50,000 psi (2,000to 3,500 bar). Piping is a special high-strength alloy tubing, usually unweldable, usually autofrettaged or deliberately overpressured to produce plastic deformation and compression in the inner regions of the pipe wall while still in tension in the outer regions of the pipe wall. Sections of tubing are joined with common ring or lens ring gaskets that seals by means of plastic deformation, with the seating surfaces being on the ends of the tube. Valves and fittings are block forgings. Surface finish of the tubing is very carefully controlled to eliminate any discontinuities that could lead to cracking. The entire high-pressure portion of the unit is normally surrounded by a concrete blast wall. Newer process had made it possible to produce polythylene at much lower pressure, but many of the high pressure plants still exist.

**Sulphur**

Sulphur is usually piped in the molten state, at a little over 400°F (200°C). Piping is carbon steel. The difficulty with sulphate is that when it freezes, it becomes like yellow concrete. It has poor heat transfer qualities, so it is very difficult to remelt sulphur that has solidified in a line. Virtually all molten sulphur piping is fully steam jacketed, so that continuous heat input is available. Valves in sulphur line are normally also fully jacketed, because merely wrapping the valve with steam tracing tubing cannot provide enough heat input. Jacketing can take the form of a steel jacket directly welded to the valve body. or a special aluminium casting that encapsulates a steam chamber and is then bolted around the valves. Some special valves, such as butterfly valves in sulphur vapour service, also have the shift drilled for a steam flow through the inside of the shaft and disc. Piping normally has flanges every 20 feet or so, because of the jacketing and to permit disassembly and rodout to remove sulphur build up on the pipe walls. Changes in direction are usually made with flanged crosses, to permit easy access for rodout

**Carbon Dioxide**

Processes that produce $CO_2$ may operate in the range of -40°F, where normalised steels are required. Trim should be 316 stainless. Where low temperature are not a factor, carbon steel is adequate for dry $CO_2$ but wet $CO_2$ can be very corrosive, generally requiring stainless steel Production services where wet $CO_2$ and wet $H_2S$ are both present are so highly corrosive that duplex steels or Inconels are sometimes required.

**Cryogenic Services**

Stainless steel is almost always required below -50°F (-45°C). Most code allow stainless steels to be used to -325°F (198°C) without impact testing, except for welds and components that contain welds. If stresses and conditions allow it, aluminium alloys, nickel steels, bronze or bronze alloys such as aluminium bronze can be used, but in the US stainless steel may be cheaper. Liquid services where boil off or vaporisation might be a problem (which is usually the case) must have some provision for venting boiled-off gases to prevent overpressuring damage. Vent holes in gate valve discs, or the use of globe valves that are inherently free from trapped volumes, are the common solutions. In most services, corrosion is not a problem, but lubricants or anything that harden or becomes brittle at the intended service temperature can not be used. The most common resilient material used is Kel. F. Vents may have double valves, so if the outer valve ices up, the inner valve can still be used to shut off.

**Caustic**

Carbon steel is adequate, but steels are prone to stress corrosion cracking so stress relieving of welds is generally used. Sometimes stress relieving is employed only for services above a certain operating temperature. Valves can be sleeved plugs or gates, either flanged or socket welded. Spray shields over bonnet and end flanges and threaded connections are normally used for personnel protection. Carbon steel valves can have F6 trim where caustic concentrations are not high, but Monel trim is more suitable for high concentrations or higher temperature.


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**Ammonia**
Ammonia is very hazardous to health when it leaks, but is not especially corrosive. Old technology uses globe valves with lead inserts in the seat for tightness, but Teflon seats are commonly used now. Globe valves are used because of their superior shutoff ability. Piping is carbon steel, but special cleaning is required to eliminate scale and water. Formerly, special square ammonia service flanges were used, sometimes with lead seals, but newer designs use conventional flanges.

**Chlorine**
Wet chlorine is extremely corrosive, and any chlorine leakages is very hazardous. Absolutely dry chlorine is not corrosive, but even the humidity in the air is enough to cause extreme corrosion. Carbon steel bodies are adequate, but trim is Monel where water is never present and Hastelloy C where wetness is possible. In line valves may have Monel ball or disc with Hastelloy C steam, and drain valves or end of line valves are all Hastelloy C trim. Ball vales must have a vent hole in the ball.

**Brine**
Depending on the concentration and temperature, brine solution can be very corrosive. Shipboard and offshore platform seawater and brine piping is often a nickel-copper alloy, sometimes bronze. Carbon steel can be used in some applications, but the corrosion rate is high. In shipboard piping, sometimes carbon steel valves with bronze trim are used for a combination of fire safety and mechanical strength with corrosion resistance.

**Acids (General)**
Corrosivity varies widely with temperature and coreactants or buffering agents. In general stainless steels are required sometimes high alloys, and valves are flanged because line replacement is sometimes needed and because threading or socket welding is prone to crevice corrosion. Block valves are often sleeved plugs because of their large sealing area. In some cases, nonmetallic piping such as PVC (polyvinyl chloride) can be employed, and there the valve of choice is the all plastic ball valves.

**Acetic Acid**
Depending on concentration, 316 stainless steel is the usual choice. If 316 is not sufficient, the next choice is Hastelloy C or C 276. Valves are usually flanged, the same material as the pipe, either sleeved plunge or ball valve that does not have a lot of internal parts, such as a top entry type. Sometimes the springs and other small wetted parts in the ball valves are titanium and in the plug valves a zirconium plug is sometimes used.

**Hydrochloric Acid**
Carbon steel piping is sometimes adequate but lined pipe, using polypropylene, PVDF (polyvinylidene fluoridel) or Saran lining, is more common. Valves are generally plastic lined but 316 can also be used.

**Hydrofluoric Acid**
Hydrofluoric acid (HF) as used in alkylation units is extremely corrosive. For predominantly HF acid streams Monel Piping is required, with Monel gate and plug valves. For hydrocarbon streams with small amounts of HF acid, carbon steel is adequate. The valves are carbon steel wi Monel trim and extra internal clearance because th hydrofluorine reacts with the steel to form iron fluorid deposits that can bind the moving parts. Valves are gate where fire safety is required and sleeved plugs where tig shut off is required. It is common to use a gate and a plu is series. HF acid is corrosive to glass, so level "gauge consist of a standpipe with a valve every 6 inches (15 mm). Level determination involves climbing down th standpipe and opening valves until liquid comes ou These valves are known as trycocks and are special glob valves with a Teflon insert in the disc.

**Sulphuric Acid**
Sulphuric acid at low velocities can be piped in carbo steel, since the acid forms a protective iron sulphide fil on the inside surface of the pipe, but above about 7 ft/se (2 m/sec) the turbulence causes the film to erode an corrosion proceeds continuously. Alloy 20 and Hastelloy is then required. Sometimes Alloy 20 is used immediate downstream of pumps and other turbulence producin equipment, with the balance of the system in carbon stee Valves can be carbon steel with Alloy 20 trim, or solid Allo 20. Solid alloy valves are normally flanged, but small ste valves can be socket welded. Vent and frain valves can b 316, since they can be cheaper than Alloy 20 and are n subject to erosion.

**Municipal Water**
Historically, large cast-iron gate valves have been used f distribution. Valves are available with ANSI flat fac flanges, with special ends for iron pipe bell and spig joints or mechanical joints with bolted gland followers, wi ends for asbestos cement or for PVC bell and spigot joint The valves themselves are either wedge gates or paral seat types, sometimes with integrally cast flanges on th side for by passes, Butterfly valves are used, normally standard design with ANSI flat free flanged ends that longer face to face than a wafer butterfly not as long as gate valve. All of these valves are normally built to AWW standards for utility work. Occasionally large plug valv have been used in pumping stations and elsewhere. Whe tapping into an existing main is required oversize valve used. Topworks are either conventional yokes wi handwheels for valves in pumping stations or elsewhe above ground, or with a standard 2 inch (50mm) squa tapered operating nut for direct burial where the top of t valve is located in a road box, or with a post indicator f direct burial or installation in a wall.

The services listed above are some that the specificati engineer is likely to encounter. Not all industries solve t same problem in the same way. But the listings include t normal materials and design solutions applied. If o needs more information on these specific services services not listed especially for speciality products, t producer of the product will generally be able to gi adequate information about acceptable materials and desi restraints. For some hazardous chemicals, the producer a few users are almost the only source of data. Spec caution, prohibitions, or recommendations will genera be stated, but most organisations prefer to stay generic, give the specification engineers latitude to do the de work on the piping or equipment specifications.

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# Utilization of Membrane Technology for Processing of Orange Juice

by
K. Kaveri and D.K. Das Gupta

**Abstract:**
***Investigations were carried out on the ultrafiltration (UF) of orange juice and its subsequent concentration by reverse osmosis (RO) using a RO/UF equipment of plate and frame configuration. The average permeate flux during ultrafiltration was found to be 20.4 L/m²h using a polysulphone membrane of 50,000 MWCO upto a volume concentration ratio of 6.5. Average permeate flux during RO of UF juice was found to 21L/m²h compared to 15L/m²h of untreated juices. Evaluation of physico chemical parameters showed negligible differences between concentrates obtained from juices with and without ultrafiltration.***

Concentration by thermal evaporation is the traditional and most widely used technique for the concentration of fruit juices. Modern plants use multieffect evaporators where time for evaporation is quite low but that is sufficient enough to affect the aroma and flavour components of fruit juices. Loss of these aroma components causes significant deterioration in the quality of concentrated juices. Another disadvantage of the evaporation process is its large energy requirements. Even with the increased efficiency of multieffect evaporators and mechanical vapour recompression evaporators, evaporation still requires about 200 Btu/1b of water removed[1]. Compared to this technique, membrane technology is a low cost method where separation process takes place without change of phase. Since heat is not applied for separation of water, energy requirement is low, thermal damage to flavour and colour is minimized[2]. Hence membrance technology may be utilized as a low cost separation technique combining ultrafiltration and reverse osmosis to clarify and concentrate fruit juices.

Since concentrated orange juice is having considerable commercial importance throughout the world, work on the membrane concentration of orange juice was reported by several authors. RO concentration of orange juice was first reported by Morgan ***et al***[3] using cellulose acetate membrane. Gherardi and co-workers[4] also used cellulose acetate membrane to concentrate orange juice upto 24% total solids. Medina and Garcia[5] concentrated orange juice using a RO system of spiral wound configuration and polyamide membrane. RO concentration of orange juice using ZF 99 composite membrane in a tubular module configuration was reported by Braddock ***et al***[6]. A process to concentrate orange juice combining ultrafiltration and reverse osmosis and reconstitution were discussed separately by Cross[7] and Koseoglu ***et al***[8]. Cross reported the use of hollow fibre configuration with polyamide membranes whereas Koseoglu ***et al*** used hollow fibre cartridges during ultrafiltration and tubular system using noncellulosic membranes during reverse osmosis. Hernandez ***et al***[9] studied the effect of ultrafiltration on soluble solids, suspended solids and aroma of orange juice using a pilot plant hollow fiber system.

One of the prime considerations to evaluate the performance of membrance separation process is the choice of membrance configuration. Since the previously reported membrane separation process for orange juice used tubular, hollow fibre and spiral wound system, the objective of the present investigation was to evaluate (i) the efficacy of plate and frame system for ultrafiltration and reverse osmosis concentration of orange juice (ii) physico chemical characteristics at different stages of processing.

*Defence Food Research Laboratory Siddarthanagar, Mysore 570011*

**Materials and Methods:**
Orange (Citrus reticulata) of proper maturity and ripeness was purchased from local market and washed thoroughly in running water. It was hand peeled and segments were passed through a screw type juice extractor and then screened through a 30 mesh sieve. The screened orange juice was then filtered through muslin cloth and pasteurized at 80°C for 1 min and cooled immediately before membrane separation.

**Ultrafiltration and reverse osmosis:**
One part of pasteurized orange juice was subjected to ultrafiltration and the separated serum was concentrated by reverse osmosis using a DDS Lab model 20-0.72m² plate and frame UF-RO system (De Danske Sukkerfabrikker, Nakskov, Denmark). The features and operation of the system was described in an earlier paper[10]. Membrane used (supplied by DDS) for ultrafiltration had a molecular weight cut off (MWCO) of 50000 (GR-51) whereas for reverse osmosis a thin film composite membrane (HC-50) was utilized. Another part of the juice was directly concentrated by reverse osmosis using same type of membrane. The operating pressure during UF and RO operation were maintained at 10 and 50 bar respectively. In all the operations four membranes with an affective area of 0.072 m² were used. Ultrafiltration was carried out till a volume concentration ration VCR = ratio of initial volume and volume of retentate) of 6.5 was achieved. RO concentration was carried out till the permeate flux was too low (6-7 L/m²h).

**Analytical methods:**
Total solids at different stages of operation was determined by drying to constant weight at 70°C in a vacuum oven. Percent soluble solids (°brix) was measured by a hand refractometer (Erma, Japan). Reducing sugar was determined by Lane and Eynon method and ascorbic acid by dichlorophenol indophenol method of AOAC[11]. Total carotenoids was determined by the method described by Ranganna[12]. pH reading was taken in a pH meter (Toshniwal CL54). Tiltratable acidity was estimated by titrating with 0.1 N NaOH and expressed as percent citric acid. Mineral matter was determined by ashing at 550°C in a muffle furnace.

**Results and Discussion:**
Changes in the permeate and total soluble solids of both permeate and retentate with volume concentration ratio are shown in Fig.1. It was found that during initial stages of ultrafiltration the permeate flux rapidly dropped from 30.5 to 25.0 L/m²h with only slight changes in VCR. From that point, change in flux with VCR was quite gradual till the VCR reached 5. After that point, change of permeate flux was not observed with the change in VCR.

Reduction of flux with the increase of VCR might be due

to concentration of polarization and fouling of the membrane As ultrafiltration proceeds, the concentration of total soluble solids and total solids increases and forms boundary layer at the surface of membrane. This gives rise to concentration polarization and the dispersed particle and colloidal substances present in the retentate causes fouling. Average permeate flux during ultrafiltration was found to be 20.4 L/m²h compared to 35.1 L/m²h obtained by Koseoglu ***et al*** in their experiment with depulped orange juice using hollow fibre system. Since they have depulped the juice fouling was less and consequently flux was more.

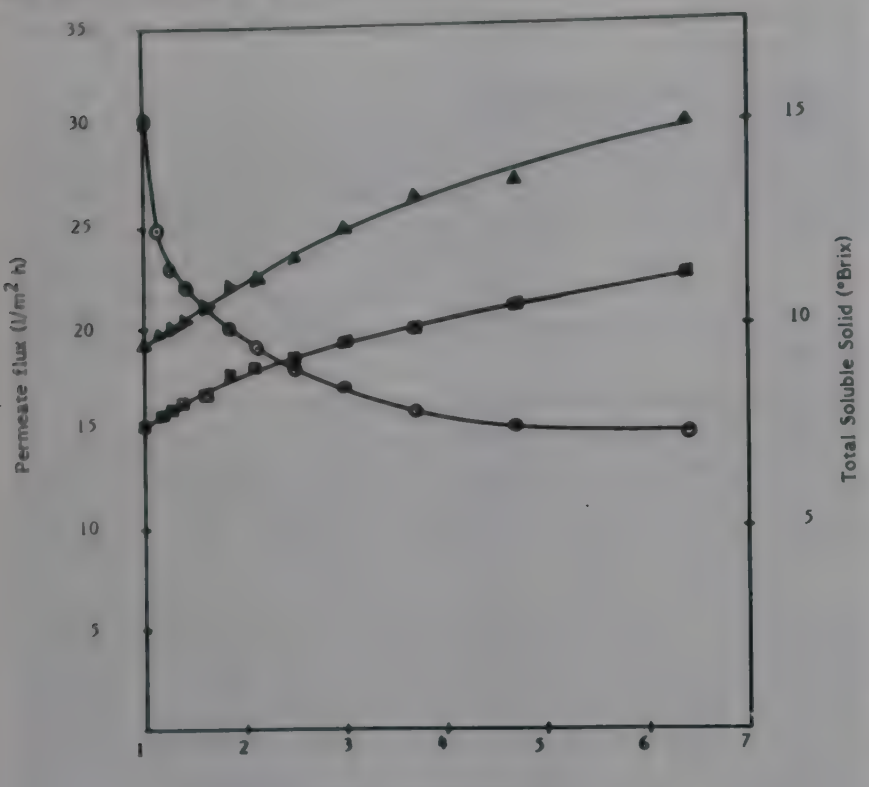


Fig.1. Changes in the flux and total soluble solids (retentate and permeate) with volume concentration ratio during ultrafiltration of orange juice.
o–o Flux ▲–▲ Retentate □–□ Permeate

Fig. 2 represents the flux as a function of feed juice concentration during reverse osmosis of orange juice with and without ultrafiltration. Both the curves showed a steep decline in permeate flux as the concentration increased. Initial flux during RO of UF permeated juice was quite high (36 L/m²h) compared to untreated (without UF) juice (27 L/m²h). Consequently average permeate flux of UF juice was 21 L/m²h compared to 15 L/m²h in case of untreated. Since the ultrafiltered juice did not contain dispersed particles,

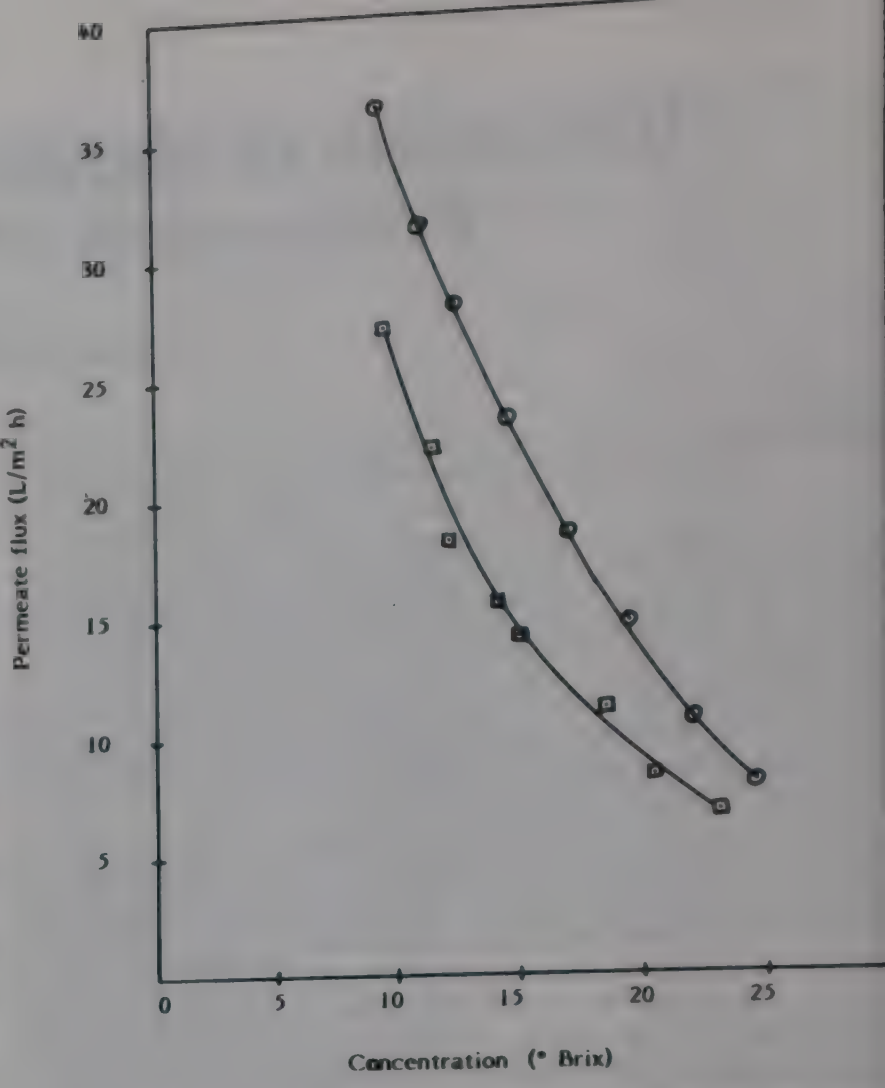


Fig.2. Flux as a function of feed juice concentration of orange juice with ( o-o ) and without ( □-□ ) ultrafiltration.

the decline in permeate flux was mostly due to concentration of polarization.

## Physico chemical characteristics:

Physico-chemical characteristics of orange juice, single strength and semiconcentrate without and with ultrafiltration are shown in Table 1. A comparative assessment between orange juice (single strength) and orange juice (UF) showed that Brix, acidity, total sugar, reducing sugar, ascorbic acid and minerals were less in case of UF juice. This may be due to clogging of membrances by pulpy materials and also due to concentrated polarization as the concentration of soluble solids increased as the ultrafiltration progressed. Ascorbic acid content was particularly quite low (17 mg/100 ml) compared to fresh juice (31 mg/100) which might be partly due to oxidation during recirculation of juice for ultrafiltration.

Similar comparison of the parameters between semiconcentrates of orange juice without and with ultrafiltration showed negligible difference. The ratio of degree Brix to percent acid was found to be slightly higher

Table -1 Physico-chemical characteristics of orange juice and orange juice semiconcentrate (with and without UF*) obtained using thin film composite membrane at 50 bar pressure

| | pH | °Brix | Total solids (%) | Acidity (%) (as citric acid) | Brix/acid | Asocorbic acid (mg/100 ml) | Reducing sugar (%) as dextrose | Total sugar (%) as dextrose | Minerals (%) |
|---|---|---|---|---|---|---|---|---|---|
| Orange juice single strength | 3.55 | 10.0 | 10.5 | 0.78 | 12.8 | 31.0 | 5.3 | 9.6 | 0.62 |
| Orange juice (UF) | 3.48 | 9.5 | 9.6 | 0.72 | 13.2 | 17.0 | 4.1 | 8.3 | 0.53 |
| Orange juice Semiconcentrate | 3.49 | 23.8 | 26.0 | 1.72 | 13.8 | 30.0 | 10.2 | 23.7 | 0.9 |
| Orange juice Semiconcentrate (UF*) | 3.52 | 24.0 | 25.8 | 1.80 | 13.3 | 31.0 | 8.5 | 23.8 | 0.84 |

*UF – ultrafiltered with an UF membrane of 50000 MWCO.

n case of semiconcentrates without UF was due to less cidity in the concentrates without UF. Since the ratio of egree Brix to percent acidity was reported[13] to have a ositive corelation with flavour sensation, it may be oncluded that flavour of semiconcentrates without UF as more perceptible than with UF.

**Conclusion:**

he data obtained from this study showed that orange juice ould be ultrafiltered and subsequently concentrated by O to 24° Brix from 10° Brix removing about 65% water. he ultrafiltrated juice showed much higher permeate flux han untreated juice during RO concentration Permeate lux during ultrafiltration was considerably reduced after a CR of 5.

**Acknowledgement:**

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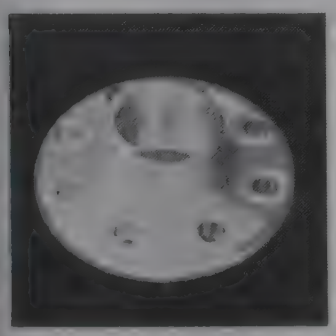
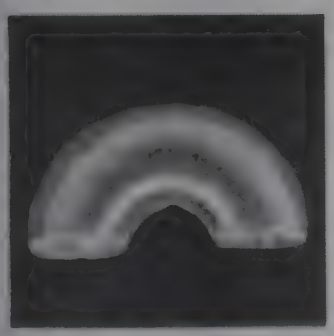
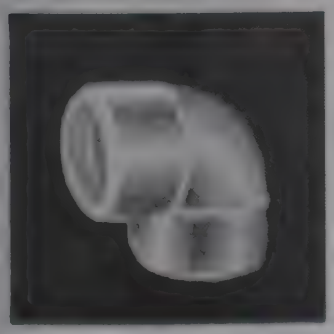

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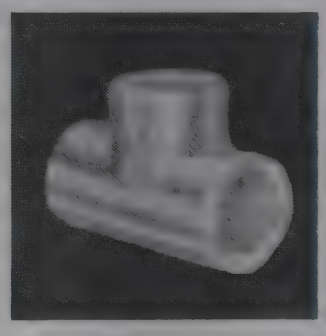

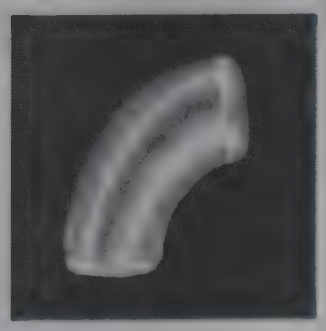

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**BEVERAGE & FOOD WORLD**

# Path to Safe Drinking Water

## Reverse Osmosis is now available in India at an Affordable cost

Reverse Osmosis (R.O.): also known as hyperfiltration is arguably the finest water purification technology in the world. It is the reversal of natural flow of Osmosis. Osmosis involves the passage of water from the selection containing lower concentration section when a semipermiable membrane separates the two In R.O sufficient pressure is applied to force the water to flow through a membrane in a reverse direction. Thus screening out dissolved salts and other contaminants produces pure water. It can improve the colour, taste, odor and other properties of water

**Membrane:**
R.O. membrane is the heart of the process. It is made up of semipermiable materials like cellulose acetate, aromatic polyamides, and polysulphonated polysulphone. It can be made as fine sheets, tubes and fine hollow fibers with pore diameter ranging from 0.5 mm to 1.5 mm. R.O. Removes all dissolved salts, sugars, bacteria, viruses, pyrogens, proteins, dyes and other particles with a weight greater than 150-250 Dalton can be removed by R.O.

**How R.O. is different from other water filters:**
Ordinary filters can remove only the suspended particles while R.O. can remove the dissolved contaminant, molecule by molecule. It is a cross flow system with feed water flowing parallel to the membrane so that, the rejected salts are swept away from the pores of the membrane by the flow.

**R.O. Finds wide application in:**
• Desalination of sea or brackish water to produce pure water • Treatment of Municipal and Industrial waste water to recover water for reuse • Mineral Water production for packaging bottled water • Ultra pure water for pharmaceutical application • Pure water for food processing industries • Pure water for production of beverages and soft drinks • Ultra pure water for electronic, semiconductor industries.
• Boiler feed water for energy conservation by avoiding blow down • Process water for Drugs, Chemical, Textiles and other industries • Domestic water purifiers. It coves complete spectrum from Domestic Drinking Water filter to very large industrial applications and sewage treatment.

**Advantage of R.O. Filtration System:**
- Minimum use of chemical makes it environmentally friendly.
- Simple process requiring minimum operational and maintenance cost.
- Very high productivity to space ratio.
- Low regeneration cost.
- Low energy requirement.

**New Development in R.O.:**
Advances in the research and development in the field of R.O. has resulted in the development of membrane which are characterized by higher per-meate flow, higher salt rejected, higher temperature and pH tolerance etc. There have been a lot of improvements in the engineering features, system control and cost reduction.

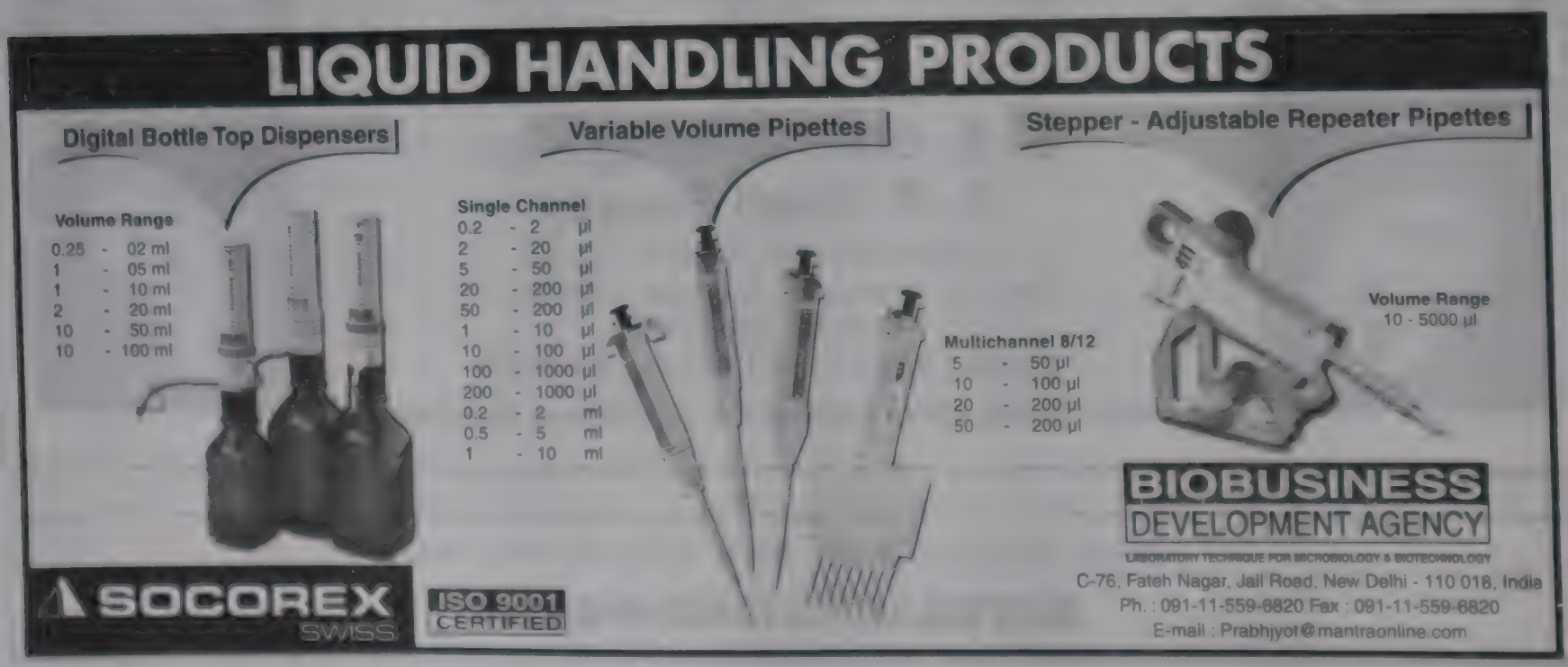
**Functioning of R.O. System:**
Has been substantially improved when it is used in combination with multiple membrane systems, ultrafiltration or ozonation for best results.

**Removal of Impurities:**
Reverse osmosis system will remove the following impurities – Bacteria – Viruses – Parasites – Barium – Cadmium – Chromium – Copper – Crystal – Fluoride – Lead – Mercury – Nitrate – Nitrite – Radium – Selenium – TDS – Turbity.

**Some clean benefits of 'Britomatics' R.O. Water:**
- Delicious, sparkling-clean drinking water.
- Pristine, flavorful coffee, tea and juice.
- Clean rinsed, fresh fruits and vegetables.
- Crystalline, harder and clearer ice cubes.
- Better tasting soups, sauces and meals when prepared with R.O. water.
- Cost effective. The daily cost of bottled water will no longer be a concern.
- Convenient, Fresh, Clean water, ready at your tap.

**Even more uses of R.O. Water:**
- Rinse your glassware in R.O. water for spotless, sparkling results.
- Nourish your plants and flowers with fresh water.
- Fill your aquarium with clean, clear water.
- Prolong the life of your humidifier or steam iron.

*Courtesy: Britomatics Engrs. Pvt. Ltd., C-9, Nand Dham Industrial Estate, Marol Maroshi Road, Marol, Andheri (E), Mumbai 400 059*

# Non-alcoholic drinks: Steady growth around the world

According to a report received from Messe Münchem GmBH, Germany organisers of "Drinktec Interbrau" exhibition, world beverages consumption has risen by around three percent annually for the last six years. The main engines behind this growth have been, quite clearly, non-alcoholic drinks and bottled water. Rapid growth in the non-alcoholic drinks segments has been observed almost all around the globe and in all cultures.

**Europe**

Germany is regarded as the biggest market for non-alcoholic drinks in Europe. According to figures from an industry association for non-alcoholic drinks per capita consumption of non-alcoholic drinks in the country rose to 253.1 litres in 2000. For the first time the magic figure of 250 litres was surpassed. In 1998 annual per-capita consumption was only 237.6 litres. Sales in this segment reached around DM 17 billion. According to the German Fruit Juice Industry Association, Germans are world leaders in fruit-juice drinking, at 40.5 litres per head. In 1999 mineral water was the thirst quencher no. 1 in Germany, where sales of over ten billion litres represented a record for the sector - and an increase of 4.7% Per-capita consumption rose to 97.1 litres. This puts German mineral-water drinkers in third place overall in Europe. Only the Italians drink more mineral water (155.0 litres), and the Belgians (123.0 litres) In fourth place are the Swiss with 95 litres, ahead of the French with 89 litres (*Sources: Unesem-Gisemes*).

In western Europe the market in non-alcoholic drinks has risen by 14 percent overall in the past few years, according to figures from the latest studies by Wild Werks, Heidelberg. This is due mainly to the greatly increased consumption of bottled water, non-carbonated drinks and iced tea. The latter is gradually being replaced by spritzers. A number of innovative new drinks, which take into account the trend towards health, wellness and convenience, are also playing an important role.

Above-average growth was registered in Italy, Finland, Ireland and Portugal. Of the five largest markets (Great Britain, France, Germany, Italy and Spain), Spain recorded the highest rise in per-capita consumption - at 28 percent in the last five years. Within the European Union, Per-capita consumption of non-alcoholic drinks presents a very heterogeneous picture. While the Belgians drink 257 litres per head, the Dutch lag far behind on 153 litres, and the Finns also, on 130 litres.

In Eastern Europe, too, non-alcoholic drinks and bottled water have spearheaded the growth. With average consumption of 51 litres of non-alcoholic drinks (per person per year), Eastern Europe is nevertheless still far behind the Western European averages of 206 litres per head per year, according to *Birkner's Journal 2000/2001*. The highest Eastern European per-capita consumption of non-alcoholic drinks is recorded in the Czech Republic, at 187 litres, ahead of Slovenia (179 litres), Hungary (149 litres), Slovakia (145 litres) and Poland and Croatia (both 108 litres). The average Ukrainian, by contrast, consumes only 212 litres of soft drinks per year, and the average Russian, 24.

Poland is one of the world's leading producers of apple juice concentrate. It has gained considerable significance in recent years in the whole fruit processing and beverages manufacturing sector. With 38 million inhabitants, Poland is by far the most interest economically of the EU candidates, and the one with the largest consumption figures. According to statistics from the Polish Ministry for Agriculture and Rural Development beverages production by private companies roses from 19% to 75% of the country's total in just last five years (1993-1997). The manufacturers of mineral water, juices and other non-alcoholic drinks turn over $680 million per year, and represent the third-strongest branch of the economy, after the breweries ! Two thirds of investment in the foodstuffs and beverages industry goes into machinery and equipment, and around ten percent into means of transport.

**North America**

The US beverages market is seen as the world's trendsetter. Here, there is enormous growth potential in functional drinks. A 1999 study showed that over 18 percent of the new alcohol-free drinks claimed an added health benefits, whereas in 1996 only 6.7 percent did. Depending on ingredients, these new products are supposed to be variously "stimulating", "stress-reducing" or simply "health-promoting". This trend can now be seen around the world. In energy drinks, too, things are happening on the American drinks market. Companies like Hasen, Gatorade and Anheuser Busch have introduced new energy drinks. The potential in this beverages segments is out at $2 billion in net sales in the US. In total, according to the Wild study, the US experienced 2.7% growth in sales of non-alcoholic beverages in 1999.

**Southeast Asia**

China is regarded in the beverages sector as the market of the future. The country is the world's biggest producer of fruit, at over 50 million tons (source: Rabobank, Frankfurt), In 1999 the Chinese drinks market registered growth of 30 percent. A considerable part in this was played by soft drinks and bottled water also showed impressive growth rates. The absolute winner in China in 1999 was iced tea, where sales rose 114 percent over the previous year.

As for the future, Zenith International predicts that by 2003 there will be a further rise in worldwide beverages consumption of more than 100 billion litres. Over 50 percent of this growth will be accounted for soft drinks. Non-alcoholic drinks will thus in future be the most important performer in the international beverages industry.


**WE INVITE EDITORIAL CONTRIBUTIONS**

If your technical/marketing personnel wishes to contribute an Article or Technical paper relating to Food & Beverage processing, we would be happy to publish it. The Articles should be of a general nature, not specially promoting products of your company

If your paper/article does not have any diagrams you may send it to us by Email or an Floppy set to MS word or PageMaker 5.0

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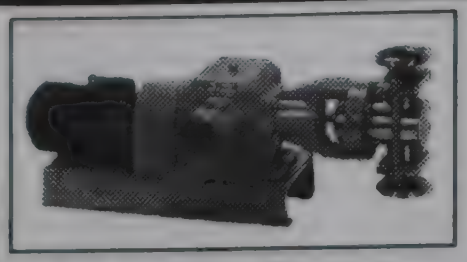

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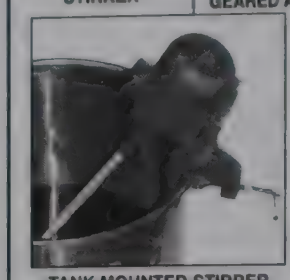
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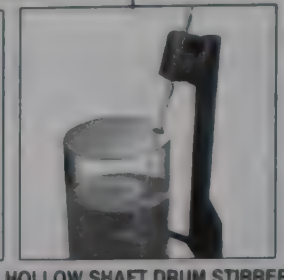
S. S. TANK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# GEETA FOOD ENGINEERING

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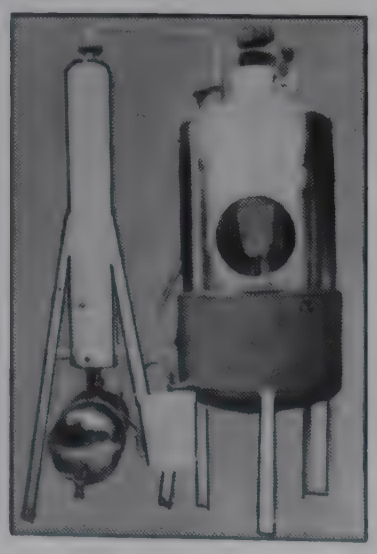
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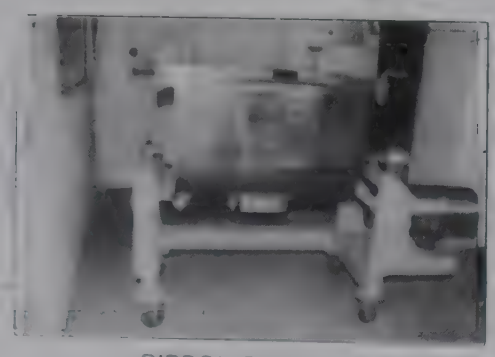
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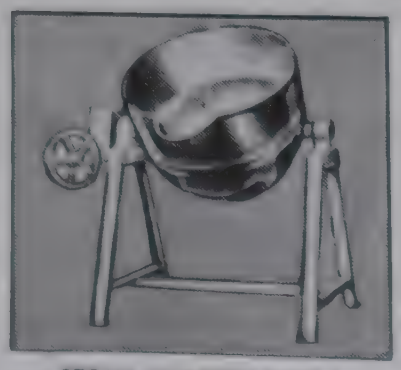
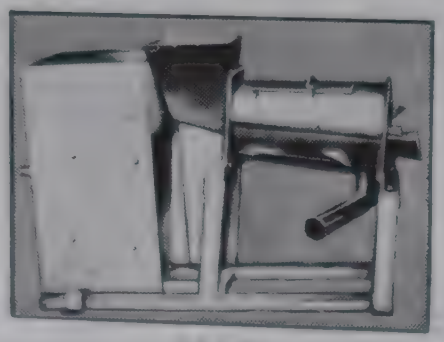

STEAM JACKETED KETTLE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# PRODUCT REVIEWS

## INNOVATIVE AND TECHNOLOGICALLY ADVANCED QUALITY SYSTEM

KOMAL industries is a Water Treatment Plant manufacturing company dedicated to offer to customers the finest commercial, industrial and medical Reverse Osmosis system. They are committed to provide the most innovative and technologically advanced quality system. Their knowledge and experience enables them to manufacture most of the parts in-house to ensure system reliability.

**Komal Reverse Osmosis System:** The unique features of KOMAL Reverse Osmosis (RO) system allows you to produce consistently high quality water for a variety of applications with their compact design, low maintenance, simple in operation and low-maintenance, KOMAL systems are perfect for your use.

Compared with other conventional Water Treatment processes, Reverse Osmosis has proven to be the most efficient means for removing salts, chemical contaminants and heavy metals. Reverse Osmosis system removes not only salts, but micro-organisms, many high molecular weight organics, viruses, silica and particulate matters.

**Process:** Osmosis involves the exchange of dissolved substances through a permeable membrane. If the natural process of osmosis is reversed by exerting on the region of greater concentration a pressure higher than the osmotic pressure in the solution, the water diffuses through the semi permeable membrane to the other side of the system. Because the dissolved salts in the concentrated solution do not pass through the membrane, this solution becomes highly concentrated than the solution originally added to it.

If concentrated solution is continuously added to this cell under the external pressure, then there is a continuous flow of pure water from it through the membrane to the fresh water compartment. Today large number of RO Plants are in operation in all capacities ranges, especially for treating drinking water, ultra-pure water, industrial/ brakish and sea-water.

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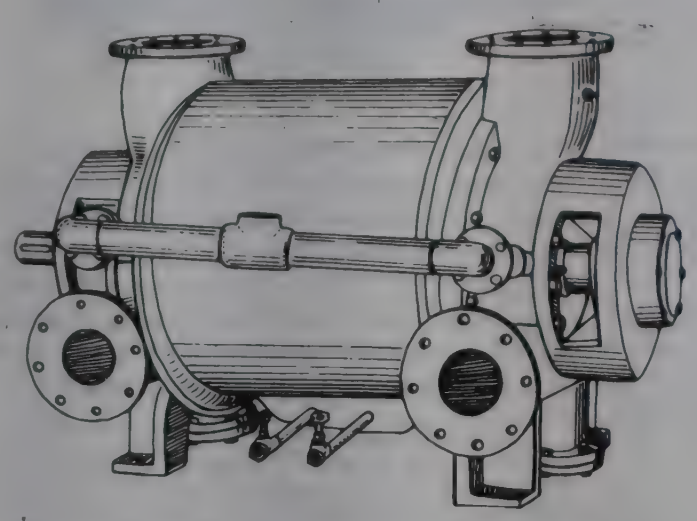

**"AEROMATIC"** offers Water Ring Vacuum Pump and Compressor having non-Pulsating Vacuum and Pressure. Energy saving pump, designed by operating at low periphery speed and for specific Power of 60 to 65 M3/Hr per KW. Pumps are available in wide selection for any requirement range from 20 to 7000 M3/Hr. Vacuum upto 700 mm Hg and Pressure upto 3.5 Kg/Cm2. The Vacuum Pump with Air Ejector are available having capacity from 50 to 2000 M3/Hr. and vacuum upto 25mm Hg abs.

No lubrication is required and can handle Air/ Gas/Air with Water comfortably. Standard Pumps are available with stuffing box type gland seal arrangement and can also offer with Mechanical Seal.

Easy to maintain the Pump as axial clearance are in mm size.

Impellers are duly dynamically balanced as per ISO 1940-1973 (E) Class G 6.3.

Vacuum Pumps are available in CIFG-260, Gun Metal, Phosphour Bronze, Alummnium Bronze, SS-304, SS-316 and other Alloy Steel material as per requirements.

Widely used in industries like Chemical, Pharmaceutical, Fertilizers, Paper, Sugar Coal Mines, Power, Steel, Refinery, Dairy, Plastic, Food Processing, Textile etc.

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Their Granular Varieties of activated Carbon are manufactured out of Coconut Shell Charcoal in the form of Hard Granules of Different Mesh sizes like 4x8, 8x16, 16x32 or any other desired meshes. They are packed in various absorptive power expressed as Iodine Value. These are used specifically and essentially for Portable Water Purification, De-Chlorination, as well for Effluent Treatment of Water.

Their Speciality of Silver Impregnated Carbon are used to Eliminate Bacteria. The Iodine Impregnated Carbon is extremely popular for disinfection for Purified Portable Drinking Water.

Powdered varieties are made from soft wood charcoal. Namely Eucalyptus, Poplar, Pine etc. which are meant for decolorizing, Sugar, Syrups, Beverages, Honey, Pharmaceuticals, Basic Drugs and so on.

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## FILTERS AND FILTRATIONS SYSTEMS

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The latest in the range are the Pall Cartridges from USA. The Polypropylene cartridges are of three types • Progard • Profile II filter Cartridges • Ultipleat.

**Pall Progard:** These are excellent high performance polypropylene non-woven filament cartridges. They are stable upto temperature of 82 degree Centrigrade and do not shed fibres or allow particles to by pass.

Available in length from 10 inches to 30 inches and with micron rating of 1.5 and 10 microns. Economically priced and having applications in food, Beverage and mineral water.

**Pall Profile II Filter Cartridges:** These are continuously graded depth polypropylene fibre cartridges. In conventional depth, filters fibre diameter is same throughout the cartridge diameter. In Profile II, elements are built by varying the fibre diameter and maintaining the fibre density. The major advantages of Profile filter are High dirt retention capacity, long life, no media migration and available in micron ratings from 1 micron to 90 micron. Applications include all liquid filtration system where absolute is required. Ideal for Mineral water, Food industry & Pharmaceutical industry.

The crescent shaped pleat structure allows more filtration are to be incoprated. The filter offers a pressure drop as low as fifteenth that of a conventional depth cartridge and less than half of the typical pleated cartridge. Ideal for fine filtration. It is available in lengths of 10 inches to 30 inches and in micron ratings from 0.2 micron nominal micron to 5 nominal micron pore sizes. Applications include all critical filtration requirements.

Pall filtration products are a breakthrough in filtration technology and are accepted worldwide.

*For more details, contact:*

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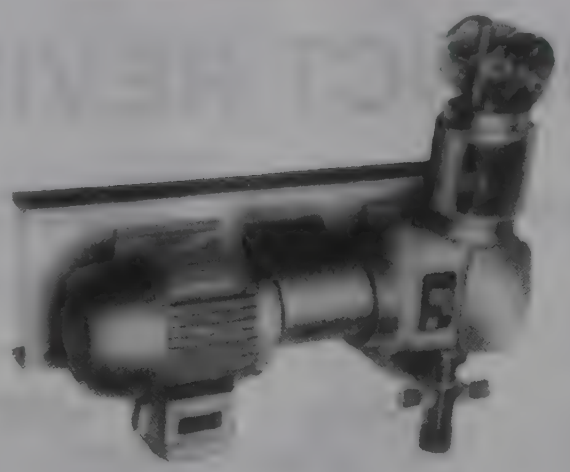
## METERING/DOSING PUMP



"Jew" offers Metering pump for accurate transfer of chemical in required capacity with pressure in Plunger & Diaphragm type from 2 LPH to 6000 LPH with pressure range upto 200 Kg/Cm2. Recently supplied pump for 5000 LPH in Double Diaphragm type in S.S. 316 material w by pass facility. This year "JEW" Pum have been exported by their OEM clien Manufacturing product range includ Pressure Relief Valves from ¼" to 2" a pressure range up to 250 Kg/Cm2 w Double seating i.e. Silicon Seating supported by Metal S.S. 316. Spec Stellieted seating can be offered for stea with the particles.

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Website: www.jewpump.com

## WASTE WATER TREATMENT

**Aqua Filsep Inc.** committed to Water and Waste Water Treatment, have considerable experience in providing to the industry, solutions to water and waste water treatment. Consequently, the company has developed expertise in process equipment, control design, and construction of custom-engineered systems for a wide range of applications, with active support of their associates, Osmonics Corporation, USA and Aquafine Inc., USA.

The various products that **Aqua Filsep** offers are * Water and Waste Water Treatment Plants * Reverse Osmosis Plants, * Demineralisation Plants * Water Softening Plants * Sand Filters and Activated Charcoal Filters * Chemical Dosing Units* Mineral Water Plants * Swimming Pool Water Purification Systems * Waste Water/Effluent Treatment Plants * Clari-flocculators, Clarifiers, Aerators. Water and Fuel Treatment Chemicals (For Boiler and Cooling Water Systems):

1. Corrosion Inhibitor 2. Scale Inhibitors 3. Oxygen Scavengers 4. pH Boosters 5. Fuel Additives & Combustion Catalysts.

Other Related Products, Spares and Components include: * Membranes, Resins * High Pressure Pumps, Pressure Boosting Systems * Pressure Vessels * Storage tanks for special purpose etc.

**The services that the company offers include:** After-Sales Services & Annual Service Contract * Modification/ Automisation of existing Water & Waste Water systems etc.

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## GELATIN FILTRATION

Filtration of gelatine usually involves multi-stage process. The first filtratio removes coarse particles and suspende matter. Secondary or further filtratio improves the clarity and brightness of th liquor.

Where the manufacturing proces involves the use of ion exchang columns, the coarse filtration step take place before ion exchange to remove an contaminants, which would foul the io exchange beds.

Primary filtration is usually carried o with kieselguhr acting as a filtration a and uses Carlson's W2 high performanc filter support sheets. Specially designe for this type of application, W2 shee offer a number of benefits to the gelatin producer.

The W2 sheets are manufactured fro pure cellulose incorporating careful chosen wet strength resins within t cellulose matrix. Consequently, the she has a high wet strength and is very durabl This allows the sheet to be washed dow between the filter, runs a number of time used time and time again, so maximisi efficiency.

The pore size distribution of the sh is carefully controlled so that there even build up of the filter cake on t sheet. This ensures that filter capacity maximised and that there is minimum r of bleed through of even the finest of t fines, whilst minimising the pressure di through the filter.

W2 sheets are ideal for use in this ty of filter due to their resistance to abrasi

W2 sheets are very tolerant of press transients during the filtration cy

because the formulation used in their manufacture coupled with the manufacturing process produces an extremely durable yet flexible sheet.

Secondary through to final filtration can take place before, during or after concentration of the gelatine liquor. As the concentration increases, so the volume of the liquor to be filtered decreases but the viscosity increases. The reduction in volume tends to decrease the required filter area but this is offset by the lower flow rate caused by the increase in viscosity. The choice of filter sheet is determined by the type of process used but typically uses XE90 to XE350 sheets. Special sheets for the higher viscosity are also available.

*For more details, contact:*

**Carlson Filteration (India) Pvt. Ltd.**
203 Malwa, Patanwala Estate
LBS Marg, Ghatkopar (W)
Mumbai 400 086
Tel: 500 6755 • Fax: 500 1358
Email: carlsonindia@carlson.co.uk

## ON LINE CHILLERS

New Refrigeration Engineers are rich in experience in the field of Refrigeration and Air conditioned unit, serving the Processed Foods and Beverage Industries. On Line chillers are ready to use with 'O' maintenance having the specific features like fully automatic and skid mounted compact units, air cooled and water cooled version. Capacities 1TR to 60TR and temperature +4°c to -40°c. Compressor Copeland Vertically sealed or Accel/ Kisloskar Open type, Glycol Used As Brine:-

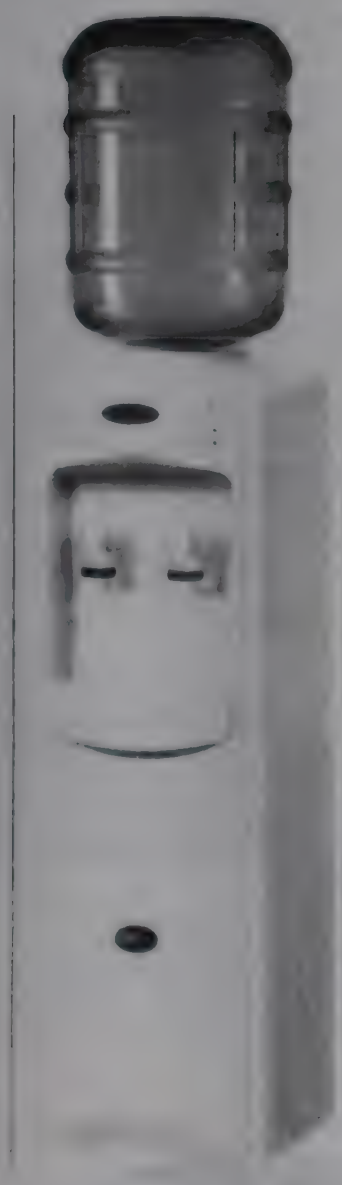
New Refrigeration Engineers are also specialised in manufacturing Central Air-Conditioning, Blast and Deep Freezers, Cold Room Storage, Shell and Tube Chillers and Condensers.

New Refrigeration Engineers is conscious of profitability of industries and hence they do undertake to overhaul and modify existing chillers and refrigeration plants as per requirement and transforms into "As New One As to be Perfomed".

*For further details, contact:*

**New Refrigeration Engineers**
R2-B-36, Matiala Extension, Part-I
(Behind Primary School)
Uttam Nagar, New Delhi 110059
Tel: 5637658
Fax: 5646624
Mobile: 9811098588
Email: rcbhatia52@hotmail.com

## HOT AND COLD DISPENSER



The elegant Hot and Cold Dispenser is assembled with imported components from one of the internationed acclaimed market leaders from Korea. The Dispenser is equipped with "Water Guard System" which protects water from external contamination by preventing entry of air borne particles and lets constant flow of water without turbulance. Designed to hold any make of 20 lts capacity bottle without spillage. Aesthetically contoured ABS top and side panels augument the decor. The dispenser features LED displays for Hot and Cold function and adjustable thermostats for accurate temperature control. The other features include dripfree faucets and hermetically sealed LG compressor. High quality stainless steel hot water tank and high impact LDPE cold tank is employed. The Dispenser occupies just a little more than a square foot area and weight approximately 20 kgs.

*For futher enquiries, contact to:*

**Atco Healthcare Limited**
Plot No.2, Kurla Industrial Estate
Nari Seva Sadan Road
Narayan Nagar
Off L.B.S. Marg
Ghatkopar (W), Mumbai 400 086
Tel: 022-509 4046 / 47 / 48
Fax: 022-5106232
Email: ahcl@vsnl.com
Website: www.brilliantwater.com

## WATER TREATMENT

Techno Aquatreat is a company that solves the problems relating to water. They offer waste water treatment/effluent treatment plants which are eco-friendly and control pollution as per the statutory requirement of the Government.

Activated carbon filters and filtration plants are the hallmark achievements. Any water treatment, Ion exchange resins, chemicals for boilers and cooling towers are their expertise.

For purification of water as their core aim of business and service, they offer Electrochlorination Systems Seaclor Mac®, Turnkey Projects of Mineral Water Plants, D.M. Plants & Reverse Osmosis Plants.

From the span of washing stage till the time of finished products the food and beverages to be hygienic and "Ready to Eat and Drink" is of paramount importance of Techno Aquatreat P. Ltd.

In order to save the cost of industries of competitive edge they undertake overhauling/modifying/service to give a new lease of life to existing systems/ plants.

*For further details, contact:*

**Techno Aquatreat Pvt. Ltd.**
2G, Church Compunds
Sukhdev Vihar
New Delhi 110025
Tel: 011-91-6917749/7286 (R): 6235461
Fax: 011-91-6926284
Email: technoaqua@satyam.net.in

## FULLY AUTOMATIC DEMINERALISER

The water produced by the AQUOION ADCA meets the standard of laboratory reagent grade of high purity water.

The equipment is comprised of an automatic microprocessor based control unit with a set of cation & anion resin columns.

Automatic operation is controlled by the in-line purity meter, regeneration cycle timer and multiple solenoid valves.

**Salient features:** • It incorporates indicator lights to show each & every operational status • Monitor the quality of treated water at the set value before deioniser returns to service • All electronics and program timer are housed in a control box • Constant final water quality monitoring assures conformance with application requirements • System is automatically pre-rinsed prior to regeneration to ensure that no false regeneration is initiated.

*For more details, please contact:*

**Aqua Purification Systems**
23 Kumaran Nagar
Behind Doctors Colony
Reddipatty, Jagir Ammapalayam Post
Saleem 630 302
Tel: 341911, 342216
Fax: 0427-342216/445882
Email: aquoion@eth.net

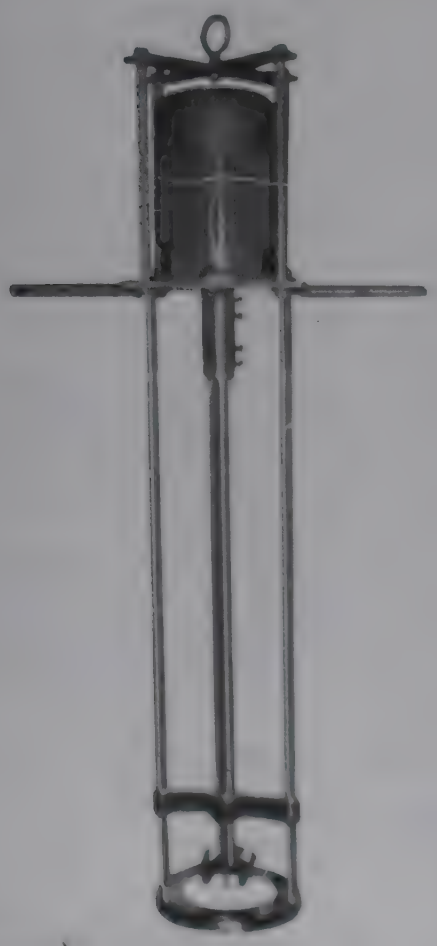
## METERING / DOSING PUMPS

Technomech Metering / Dosing Pumps are precision positive displacement plunger type pumps for controlled and high accuracy feeding of various liquids / chemicals under different discharge / pressure conditions. An integral worm reduction is used with eccentric and connecting rod to convert rotary motion into a reciprocating motion. The crank can be adjusted by means of a micrometer which changes the eccentricity of crank and consequently the stroke length. The pump output is manually adjustable while it is in operation or at rest from 0 to 100% through a micrometer which is calibrated. The drive side mechanism is enclosed and runs in an oil bath. These pumps are supplied with motor coupled together by a flexible coupling and mounted on a common base plate in a ready-to-use condition. Motors can be offered in TEFC weather proof, flame proof, explosion proof versions as per specific requirement. Liquid ends of pump can be offered in CI, SS-304, SS-316, Alloy-20, Polypropylene Hastalloy B & C, Teflon dependin on applications. Different models ar available in the range of 2 to 200 Ltrs//Hr. The pressure can be offere to maximum 200 kg./CM2. Thes pumps are capable of continuou duty and can handle liquids chemicals either acidic or alkalin with high repetitive accuracy at an single setting. These are suitable fo continuous process plants where fee volume needs to be adjusted often. Thi can feed viscous polymers with accurac and can be used with advantage for dosin of flocculants, alum, reagents, urea etc., i water and effluent treatment and in proces industries like paper, textile, chemical etc These pumps can also be used for pumpin in fertiliser, petrochemical, sugar, therma power plants, pharmaceuticals and othe industries. In Duplex Models capacity o each pump can be adjusted individuall and can offer facility for blending or pumpin liquids of dissimilar nature. Optiona accessories include Safety Relief Valve Pulsation Dampner etc.

*For further details, contact:*

**Technomech Pumps**
Gala No. 10, Bombay Wire Compound
IP Patel Road, Goregaon (E)
Mumbai 400063
Tel: 8732455
Fax: 022-8734162

## STIRRERS



**COSYWO** has developed profit boosting design of **STIRRERS,** equipments and machinery considering Operational convenience Time Saving, Labour Saving and Trouble solving problem with guarantee for Performance, Dependebility and less breakdowns. The commitment to product development and improving process knowledge is continuous.

COSYWO's objective is Perfect job, Expertise, Quick Service, Superior quality and Fulfilment of its responsibilities to customers. They provide guaranteed solution for mixing problems.

COSYWO has vast experience in modifying/modernising/manufacturing customs built **STIRRERS** with excellent workmanship, means that no matter how small your mixing need or how large and complex you can mix with the best.

COSYWO is specialist of Rubber Sleeve Expander • Roller for Textile Steel Plastic Aluminium foil Leather cloth and Paper S S Guide Roller • Batching Roller • Cloth scutcher • Gum Mixing pans • S S size mixing tank • Water Line Sand Filte Lab Mangle • S S Poteye • S S Ager Patt • Farakadi • Reaction vessels • Ball Mil • All products are manufactured in wel equipped workshop vigorously tested and precisely inspected to achieve desired results.

They are leading manufacturers since 1960 for Stirrer • Agitator • Emulsifie • Disperser • Homogeniser • Tank Mounted Stirrer • Hollow Shaft Stirrer • Disintegrator • Geared Motor Stirrer • Drum Stirrer • Lab Stirrer • Pipe Line Stirrer • Attritor • Conical Blender.

*For further details, please contact:*

**Cosywo™ Engineering Company**
15, Laxmi Co-op Industrial Estate Ltd.
Near Nagarvel Hanuman Mandir
Amraiwadi Road
Ahmedabad 380 026
Telefax (O): 91-079-2748168/2748001
(R): 6621662
Email: cosywo@usa.net
Website: www.indianic.com/cosywo

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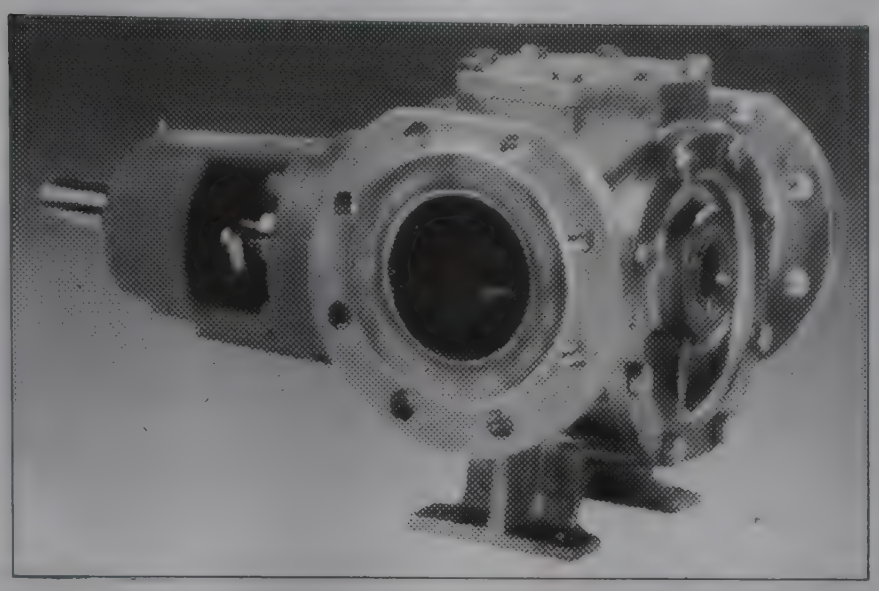
## ULTRA FILTRATION SYSTEMS

Flow Control Industries has designed, manufactured and supplied Ultra Filtration System for producing pyrogen free water for the Pharma, Food, Beverage & Dairy Industries. The system is capable of highest filtration possible including separating dissolved salts and removing bacteria, pyrogen and most organics from water. The systems is complete with multi-stage centrifugal pumps, pre-filters, cartridge filters, cartridge housings inter connected piping and valves and sophisticated instrumentation and electrical controls. The same process could be used for concentration of antibiotics, fruits juices, enzymes, wines, starch etc., The Ultra Filtration Systems are custom designed and available in a choice of configurations to meet a wide range of purification applications.

*For more information, contact:*

**Flow Control Industries**
27-A, Shukla Estate
Oshiware, S.V. Road
Opp. Veena Dalvai Indl. Estate
Jogeshwari (W)
Mumbai 400 102
Tel: 678 8805, 678 7104
Telefax: 678 6995
Email: flowcont@bom3.vsnl.net.in

## INTERNAL GEAR PUMPS



Johnson Pump (India) Limited Ahmedabad, in collaboration with the world-renowned Johnson Pump International AB Sweden, has introduced a range of positive displacement pumps for the Indian market, namely the Internal Gear pumps, Rotary Lobe pumps and Flexible Impeller pumps.

The range of Internal gear pumps type SRT and SRTM are heavy duty, compact and robust, based on the well known and proven techniques of having just two moving parts - the rotor and the idler gears.

These self priming pulsation free pumps are of back and front pull out design and offer a variety of sealing and construction material options to choose from. for handling any kind of high or low viscosity liquids.

The SRTM pumps can be offered with application design features and are also available in designs conforming to API 676.

The industries in which SRT and SRTM pumps find application include: • Petrochemical industries • Paint industry • Food ind-ustry • Soap and Detergent industries • Paper industries • Sugar industries.

*For further details, contact:*

**A.T. E. Enterprises Limited**
A-19, CTS No. 689
Veera Desai Road
Andheri (W)
Mumbai - 400 053
Tel: 022-6346610
Fax: 022-6346609
Email: pumps@ateel.com

## SPRING FRESH - THE COMPLETE WATER TREATMENT COMPANY

Drinking water sources have been found to be contaminated by Industrial wastes, pollutants, heavy metals, pesticides, fertilisers, bacteria, viruses, parasites like amoeba and contaminants like nitrates, fluorides, iron, manganese, lead etc.

Spring Fresh, has recently introduced a wide range of water filters and purifiers which remove these water pollutants and contaminants to produce clean and healthy drinking water.

These products include: •**Commercial Water Purification Systems:** Commercial Reverse Osmosis Systems for production of Pure Water, Water Softeners, Water Filters, Iron Removers, Carbon Filters, Filters for Water Coolers, Ultra-Violet Water Sterilisers and Hot and Cold Water Dispensers.

• **Drinking Water Systems:** Non electric Water Purifiers, Contaminant Removers for removal of Lead, Fluorides, Nitrates, Iron & Manganese, Ultra-Violet Water purifiers, Reverse Osmosis Systems and Water Dispensers.

The above systems are suitable for Hotels, Restaurants, Resorts, Schools, Colleges, Mineral Water Suppliers, Beverage Companies, Alcoholic and Non Alcoholic, Food industry, Dairy Industry, Bakeries etc.

Spring Fresh Systems are manufactured using Internationally certified Quality Components to ensure long life and efficient working of the equipments.

*For further details, contact:*

**Spring Fresh Water Treatments Limited**
606, Eros Apartments
56 Nehru Place
New Delhi 110 019
Tel: 011-6419319, 6216239/7331/7345
Fax: 011-6464340
Email: infonet@giasdl01.vsnl.net.in

**Bangalore Off.:** Union Street
Shivaji Nagar
Bangalore 560 051
Tel: 2864151

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## WATER PURIFICATION TECHNOLOGY

Pollucon Enviro Engineers Pvt. Ltd. (PEEPL) manufactures water and waste water treatment systems for business and industries. Commercial/Industrial systems are available with a wide array of options for non-standard applications.

Reliable equipments, turnkey services, build-own-operate.... whatever the project, whatever the application, PEEPL is the single source for all your waste water treatment needs. Nobody offers more technology, more experience, more service, more business options.

From your initial inquiry, the staff of process and design engineers at our office is prepared to offer assistance with process design, equipment selection and sizing, CADD system drawings and customer service.

The company has an impeccable record for service and quality and this is because every query is treated with gravity and seriousness.

The company's service engineers will call upon the customer to obtain first hand information about the process, critical parameters, constraints etc.

Primary Market: * Commercial Complexes Sewage Treatment Plant * Food and Breweries * Pulp and Paper * Pharmaceutical * Textile Industry * Tannery * Distillery * Chemical

Pollucon Enviro Engineers Pvt. Ltd., is an engineering firm and offers various services such as designing, structural designing, construction, fabrication, erection and commissioning of Water, Waste Water and Air Pollution Control Systems.

Company Set Up: Established in 1995 with initial organization set up of three persons with two clients. Today with a good reputation and skill in the technical aspects its total strength is 35 and with about 15 to 16 clients at a time.

Pollucon Enviro Engineers Pvt. Ltd., have installed and successfully commissioned more than 50 Effluent Treatment Plants for various industries.

Their manufacturing activity, is a specialization in itself.

Equipment's Range (A): * Surface Aerators * Clarifiers and Clariflocculators Mechanism * Flash Mixer / Agitators * Flocculators * Filter Press.

Equipment's Range (B): * Pressure Sand Filter * Activated Carbon Filter * Twin Lobe Blower * Dosing Systems * Reverse Osmosis * Softner * U.V. System * D.M. Plant.

*For further details, contact:*

**Pollucon Enviro Engineers Pvt. Ltd.**
1-Om Dipti Building
Carter Road No. 7
Borivali (E), Mumbai 400 066
Telefax: 911-22-805 1534, 809 0134
Email: walke@satyam.net.in

## "PEC" SELF PRIMING SEWAGE PUMPS

"PEC" offers Self Priming Sewage pumps. A Centrifugal Pump but the casing is so designed that once it is filled with liquid, it always remains full with liquid even on stoppage thereby giving it a self-priming characteristic. The casing is provided with large passage, impellers are of few vanes, semi-open or open type so that they can handle even suspended solids. Replacable wear plates are provided on both sides of impeller. Mechanical seals can be provided in place of gland packing. Suction lift is limited to 6 mtr. Due to these feature pumps are ideal for handling sewage muddy water, trash including solids, polluted liquids, waste water, petrol, diesel, kerosen chemicals. They ar used for dewaterin foundation trenches piers, excavations, pits pot-holes etc. by Gram Panchayats, Munici palities, Public healt departments, larg housing colonies industries like chem ical, pharmaceuticals food, cement, paper sugar, steel an marine application fo liquid cargo fron freighter, barges pumping out bilges an cooling water fo marine engines. The pumps are availabl in suction and delivery size of 25mm 25mm to 100mm x 100mm covering dut range of head from 5 to 40 mtr. capacit from 60 LPM to 2400 LPM, and solids fron 5mm to 22mm. Standard material o construction is C.I., C.S., bronze, S.S. an other materials are also available. The company is certified with ISO-900 certificate.

*For further details, please contact:*

**Pump Engineering Co. Pvt. Ltd.**
C/38-39, G.I.D.C. Odhav
Ahmedabad 382 415
Tel: 2871257, 2871298 • Fax: 2874375
Email: pec-pumps@hotmail.com

## ENVIROX WATER TREATMENT/ FILTERATION SYSTEMS

Envirotech, a total water management company established in 1984 manufactures complete range of water treatment equipments. Envirotech has come out with a compact, easy to-operate MINERAL. Water Treatment System with capacity ranges from 100 LPH to 1000 LPH. The system is based on triple stage pre-filteration for removal of suspended solids, organic matters, colour, odour & free chlorine and post treatment by membrane technology using Reverse Osmosis & Ultra-filteration with blending arrangement. The treated water quality confirm to IS:13428 and meets international standard for bottled water. The complete system is fitted on a skid with all testing instruments and flow/pressure regulating devices to make the system work automatically.

*For further details, please contact:*

**Envirotech Utility**
32-A, Main Patel Road
Opp. Tata Mc-Graw Hill
West Patel Nagar, New Delhi 110 008
Tel: 5707414 • Fax: 570 1829

## TURNKEY MINERAL WATER PROJECT/WATER TREATMENT

Aguapuro Equipments offer turnke mineral water projects and water treatmen projects ranging from Dosing Equipment Multimedia Sand/Carbon Filters, Softeners Demineralisation Systems, Revers Osmosis Systems (UF/NANO), Micro Filters/UV, Sterilizer systems, Ozonators They also provide spares and services fo any make of water treatment plants.

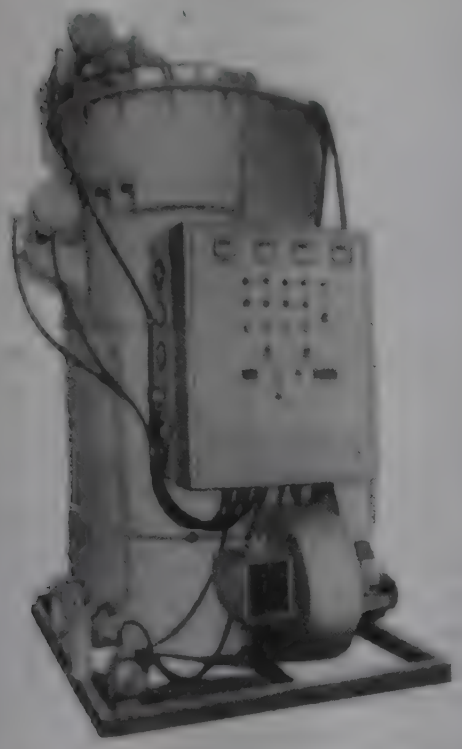
Special features of these ar
• compact skid mounted system
• specially designed for individua application • Economical and fast deliver

The company also provides turnk projects for manufacturing mineral/pur water.

*For further details, contact:*

**Aguapuro Equipments**
2/22, Panwala Bldg.
Dr. S.S. Rao Road
Lalbaug, Mumbai 400012
Tel: 4101432, 4155576
Fax: 4155576
Email: aquapuro@vsnl.com

## THERMIC FLUID HEATER & HOT WATER GENERATOR



"**AERO THERM**" offer Thermic Fluid Heater / Hot Water Generator having capacity from 30,000 Kcal/hr. to 20,00,000 Kcal/hr. max. operating temperature will be 300°C for Thermic Fluid/130°C for Hot Water. The concentric coil will be made from MS Seamless Tube of ASTMA 106 GR-B. The unit will be equipped with high efficiency Oil/Gas burner with Air Pre-Heater arrangement goves high thermal efficiency 87 ± 2% on NCV. The unit will be outside purview of IBR.

*For further details, please contact:*

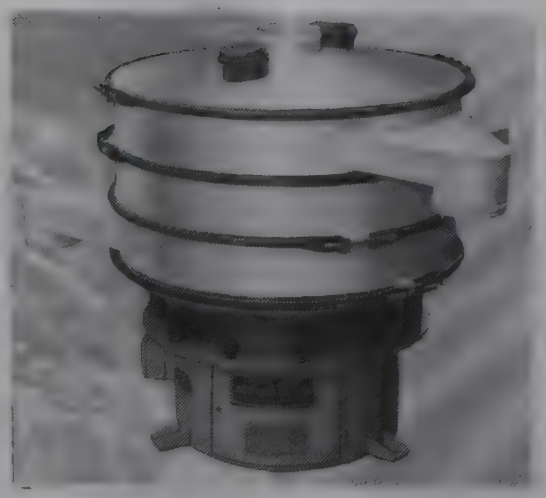
**Aero Therm Systems Pvt. Ltd.**
Plot No. 1517, Phase -III
GIDC, Vatwa
Ahmedabad 382 445
Tel: 5890158
Tel/Fax: 91-79-5834987
Email: vadher@ad1.vsnl.net.in
Website: http://www.fortunecity.com / victorian/lewis/136/index.htm

## VIBRO SIFTERS

Magumps, already a well reputed and known name in the field of pharmaceutical bulk drug process industries for high quality equipment and plants introduces 'Vibro Sifters' useful in dry separation, dry classification, straining, sieving, gradation, solid liquid separation, solid classification etc. This can be used in pharmaceuticals. grains, fertilizers, animal feeds, abrasives, pulp and paper, foods, ceramics, minerals, water disposal, chemical and petro chemicals.

The vibro sifters are manufactured with all the product contact parts in S.S. (304/316/316L quality), and is available from 12" dia to 72" dia. The sieves used, have been newly designed, simple type with soldered rim similar to mechnical sifter for ease of quick change over. These sifters are simple in construction, simple to use and maintain. They have no rubber parts and hence require minimum maintenance, 20 to 30% extra output than mechanical sifter, modular design i.e. additional decks can be added at any time very quickly, intensity of vibration can be changed by adjusting eccentric weight.

They can also be supplied with dust



cover, complete S.S. covered body as per GMP. Over 30 units have already been sold for domestic as well as export market.

*For further details contact :*

**Magumps**
Trisandhya 'A'
97, D. Phalke Road
Dadar (East)
Mumbai - 400 014.
Tel: 411 3572, 415 4474
Fax: 022-413 7648 / 8307
E-mail: magumps@bom5.vsnl.net.in

## OZONE GENERATOR & OZONE DISINFECTION SYSTEMS

Creative Concept has launched micro-processor based OZ AIR series of Ozone Generators, Ozone Sterilization Systems and Ozone Monitors for Disinfection of Air, Water and Food items. These intelligent Ozonators can decide about "Ozone Dosing" and "Duration of Operation" for achieving total disinfection in a specific area. Ozone Generators and monitors have digital Ozone Concentration Alarm settings, duration of operation etc.

Ozone is the fastest acting oxidizing disinfectant and the most efficient broad-spectrum micro-biological agent commercially available. Being highly reactive and completely non-discriminating it acts immediately. This makes Ozone a very powerful bactericidal agent. Ozone as unlike any other oxidizing agent leaves no toxic residues, thereby being environmentally friendly and helps reduce pollution.

These Ozonators are User friendly. Better maintainable State-of-the-art, equipped with a provision of remote control.

*For further details, contact:*

**Creative Concepts**
F-60, Sector 8
Noida 201301
Telefax: 011-4523339/4552249, 4543337
Email: concept@nda.vsnl.com

## FILTERS/STRAINERS

'**SHARPENN**' was promoted a decade ago by a group of technocrats to manufacture filtration equipments. The company functions with custom built equipments, particularly pressure lead filters - vertical and horizontal to handle filtration of a wide range of products for pharmaceuticals, chemicals and vegetable oil refinery industries. These filters are an alternative for the outdated plate and frame filters. The advantages of these filters are that they are totally automatic, occupies less space, less retention in the cake, no recurring expenses and eco-friendly.

In addition the **SHARPENN** range products includes drum driers, flakers for convertion of liquid into flakes, centrifuges for liquid-liquid separation, multi-bag filters and all other filtration equipments.

'**SHARPENN**' leadership position in separation Technology and oil refinery is backed by their team's qualified knowledge and years of experience. In engineering, design, drafting, and manufacturing '**SHARPENN**' does all the work with in-house facility. This advantage assures performance, service after sales you can trust, delivery you can rely on.

They are one of the very few manufacturers in the business that design, manufacture and test all its equipment with their own facilities.

*For further details, contact:*

**Sharpen Technologies Pvt. Ltd.**
Shanmugananda
D-56 MIDC
Behind London Pilsner
P.O. Box. No. 19
Nerul
Navi Mumbai 400706
Tel: 7907201/2/3/4 7613871
Fax: 91-22-7907205
Email: subra@bom3.vsnl.net.in
Website: www.indialink.com/sharpenn

★ ★ ★ ★ ★

## WATER PURIFIER

Alfa Water Purifiers are amongst the leading manufacturers of ultraviolet water purification systems in the country with an experience of over one-decade in the field. They specialise in process water applications where bacterial disinfection of process water, which is used in manufacturing and washing areas, is of utmost importance.

The Alfa AP-Series models are capable of purifying water from 100 to 1,00,000 litres/ hour based on customer's specific needs.

The Alfa systems use the principle of Ultraviolet light to purify water without the addition of any chemicals or heat. High intensity germicidal lamps totally inactivate water borne bacteria, viruses and pathogenic micro-organisms.

Alfa water purification systems find wide application where bacteria free water is required and is ideally suited for food industry, hospitals, bottling plants, pharmaceuticals, and drinking water systems and for process water in industries.

The unique advantage of the Alfa UV systems is that they offer an optional **On-Line Fail-Safe validation** with the help of the Alfa Sensor which is an Ultraviol Monitor to ensure proper disinfectio efficiencies, thus making the UV syste Reliable and Effective.

They are experts in sizing the custom er's requirements and offer profession solutions to bacterial disinfection prob lems in the process industry using the U principle.

They have successfully catered to a wide and impressive customer list. Tha includes firms like Pepsi, Parle, Kwalit Biscuits, Naik Sea Foods, Libran Se Foods, Gausia Foods. Pfizer, Baye Johnson & Johnson, Jaslok Hospita Bombay Hospital etc.

They will be able to provide a suitabl solution to your bacterial problems i water if you send them details like fee water quality, quantity of water to be pu rified per hour and specific applicatio along with a sketch of the piping layou

*For further information, contact:*

**Alfa Water Purifiers**
222, Shah & Nahar A-2
Lower Parel, Mumbai 400 013
Tel: (022) 494 5957, 495 4190
Fax: 91-22-495 4250

## ULTRAVIOLET WATER DISINFECTION SYSTEM

Ultraviolet Water Disinfection System using the latest US based Teflon® Technology is the ultimate answer to prevent pollution and contamination in water. Non-fouling Teflon® Tubes UV units for water and waste water treatment are used to over come scale problems.

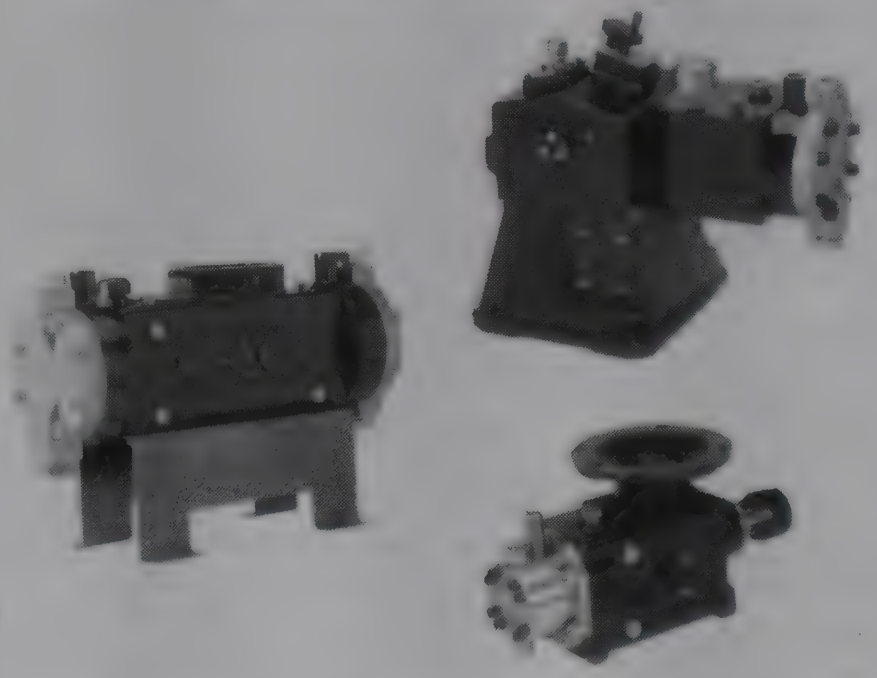
These units find application in disinfection of drinking/process water, pre-treatment before R.O., algae and slime control, purer fermentation products. The system can also be used for various industrial applications such as supply of high purity water for beverage, bottling, brewing pharmaceuticals, food processing etc. It achieves near cent percent water purity without any side effects. It is also cost effective and maintenance free.

Among the products offered are various models of water disinfection systems, ranging from 225 LPH to 12 Lac LPH of UV systems, micron filters, carbon filters, air irradiators etc.

*For further details, contact:*

**Hitech Ultraviolet Pvt. Ltd.**
P.O. Box. No. 8356
35, Grace Plaza
S.V. Road
Jogeshwari (W)
Mumbai 400 102
Tel: 6790610, 6794611 6794327
Fax: 6794337
Email: hitechuv@bom5.vsnl.net in

## ELECTRICAL METERING PUMPS



Haskel International, Inc., a worldwide supplier of air-driven pumps and other fluid power products, has acquired the Durameter line of electrically driven metering pumps. Haskel will move rapidly to expand the electric pump line and strengthen global distribution. Durameter pumps are known for their high quality and are backed by a 10 year warranty.

Durameter pumps accommodate flows from .08 gph to 2,000 gph and pressures up to 3,500 psi. they are used in many process applications including water treatment, oil and gas and petrochemical and will b marketed through exis ting Haskel an Durameter distributors i the US an overseas thro ugh Haskel' extensiv global sale and servic network.

Haske International manufacturer electrical an air-driven hig pressur pumps, hydr aulic and air driven high-pressure ga boosters, air pressure amplifiers an related equipment. It distributes an services its products worldwide throug company offices, subsidiaries an distributors.

*For further details, contact:*

**Haskel International Inc.**
100 East Graham Place
Burbank, CA 91502, USA
Tel: +1 818-843-4000
Fax: 841-4291
Website: www.haskel.com

## FILTER PRESS

The SEPRA Plate and Frame type Filter ress from Parksan Filters Pvt. Ltd. meets l specifications of the critical filtration rocess, and has applications in harmaceutical, Brewery and Soft drinks ndustries SEPRA is available in three zes. viz 60x60 cms. 40x40 cms and 0x20 cms The filter press is made of tainless steel and has roughing out, olishing and sterilizing filtration function. he change over plate permits pre-ltration combined with final filtration in e same unit. It is suitable for thin/viscose roducts.

Parksan Filters Pvt. Ltd. have a wide roduct range of S.S. 304/SS 316 Filter resses which include:

• **Ring Pack:** S.S. Candle Filter Unit **Sepra:** Plate and Frame Type Filter ress • **Liquitech:** Horizontal Pressure late Filter • **Panier:** Bag Filter System **Cartfil:** Cartridge Filter System •**Vessel:** ermentor/Reactor Vessels • **Pifit**: Pipe ittings • **Pumps:** Mono Block Design - entrifugal.

*or more details, contact:*

**arksan Filters Pvt. Ltd.**
Saraswati Indl. Estate
avghar, Vasai Rd. (E)
ist. Thane 401210
el: (0250) 338413 • Fax: 8995838
mail: parksan@bom5.vsnl.net.in

## WATER PURIFICATION / TREATMENT PLANTS

The Water Purification and Treatment lants from Environment Products (India) vt. Ltd., provide high purity bacteria free water for diverse industries such as food, sheries, poultry, beverages, pharma, elec-ronics, etc.

Water Treatment for POE/POU systems, otable purpose, aquaculture, mineral water, sewage and effluent requirements an be carried out by these machines. ccessories provided include dosers, fil-ers, softeners, polishers, ozonators, UV ystems, reverse osmosis, filtration plants, hlorinators, micron filters, DM/DI Plants, larifiers and aerators.

The equipment accessories are manu-actured for mineral water as per CODEX LIMENTARIUS specifications which is he WHO standard for pure water.

Technical Consultancy and Turnkey rojects for swimming pool, mineral water reatment and bottling plants are provided y the company.

*or more details*, contact

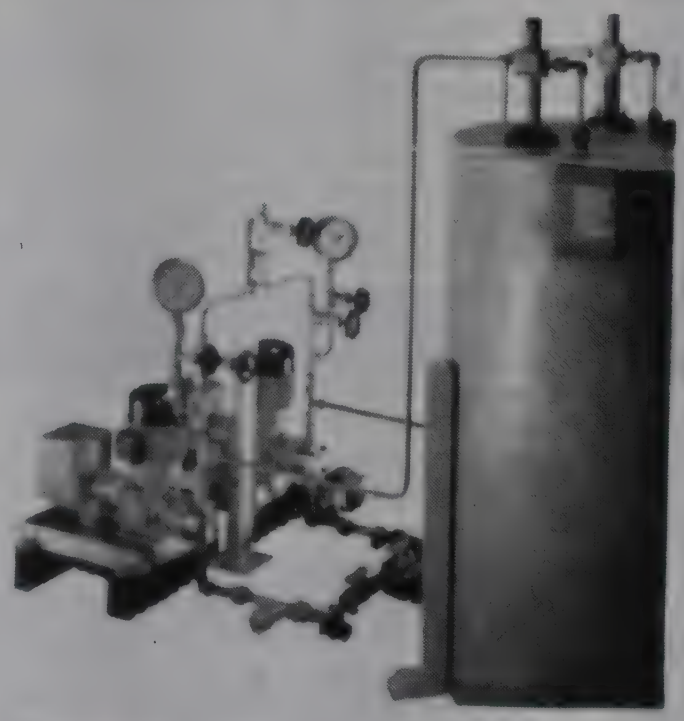
**nvironmental Products (India) Pvt. Ltd.**
60/3, Rajani House
pp. Don Bosco High School
.T. Rd., Borivili (W)
umbai 400 091
el: 8013601/801698 • Fax: 022-8621506

## DOSING PUMPS FOR WATER TREATMENT PLANT

PreciDose who believe in innovation and continuous quality improvements, have developed an alternate of electronic dosing pumps which are vertually trouble free.

The spare parts costs of the pump is very reasonable and can be maintained even by a layman.

Since the complete product range like Plunger Pumps, Single/Double Glandless Diaphragm Pumps. Below/Mechanical



Diaphragm Pumps and an alternate of solenoid operated Electronic Dosing Pumps i.e. Compact Dosing Pumps are designed and manufactured under one roof, they can also offer most suitable pumps for Alum. Polymers, HCL, 98% $H_2SO_4$, Ferric Sulphate, Caustic Lye etc., The capacity range starts from few ml./hr. to 15000 Ltrs./ hr. SS 316. Polypropylene, PVC, 25% Glass Filled, Hastelloy-C etc., can be supplied after studying the application thoroughly. Complete Dosing system with / without Automation and pH control is also possible. High Pressure Triplex Pump is also manufactured by Precidose for R.O. plant.

PreciDose Pumps and Systems also offers chemical dosing/metering pumps for various applications for different industries.

"PreciDose" pump is designed specifically for particular application so as to see that it gives optimistic performance. L.P./H.P. dosing pumps for Hydrazine and Tri sodium phosphate, glandless single disphragm pumps in PTFE or P.P. Material of construction for 98% $H_2SO_4$. Comm. HCl, Lime, Sodium Hypo and other hard to handle chemicals. Glandless Double Diaphragm (Sandwich Type) pumps are the most suitable for zero leakages well as zero contamination of process fluids in Thermal Power Stations.

PreciDose pumps are available from few ml/hr to 15000 ltr/hr. and pressure upto 400 kg/m2 in different material of construction. PreciDose also offers complete dosing systems with values, tank, agitator, skid etc., with or without automation for chemicals, pulp and paper, thermal power plants and many other industries.

High Pressure Triplex Pumps and High Pressure Hydraulic Testing Systems for Thermal Power Stations, Piping contractors etc... is also available on request.

*For more details, contact:*

**PreciDose Pumps & Systems**
9, Deep Akruti, Nr. L.G. Hospital
Maninagar, Ahmedabad 380 008
Telefax: 079-5830762, 5835062, 5893868, 5465653
Email: vbs@icenet.net

## STACKED RING FILTERS

Kumar Process Consultants are manufacturers of stacked Ring Filters, ideally suited for clarification of Sugar Syrup, Honey, Wine, Beer, Fruit Juices and Pharmaceutical products. Filter is made of a shell fitted with filter elements formed by stacking of specially designed rings on a machined rod to form a cylinderical porous structure which is rigid having a flow volute on the internals. These elements are coated with filtered to form a sturdy and porous filter bed. The fluid which is to be filtered is passed through this and the filtered fluid in taken to collection tank or for down stream processing.

The stacked filter ring is compact, requiring no consumable spares. It is made of SS316 and Sealing gaskets in Silicon, PTFE and viton to with stand hot water sanitization or stream sterilization. Unit does not need to be dismantled for cleaning.

*For more details, contact:*

**Kumar Process Consultants & Chemicals Pvt. Ltd.**
230/4, Ashoka House,
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Linking Road, Bandra (W)
Mumbai 400 050
Telefax: 6451964, 6420637, 6432512
Email: kumarfil@vsnl.com

## OZONE GENERATORS

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*For more details, contact:*

**Aqua Zone Systems & Engineering**
48-52, Cellar-Shalimar Complex
Mahalaxmi Cross Roads
Paldi, Ahmedabad - 380007
Tel: 661 2574
Email: aquazone@icenet.net
Website: www.ozoneworld.com

## SPRING FRESH - THE WATER POLICE

Drinking water sources have been found to be contaminated by Industrial wastes, pollutants, heavy metals, pesticides, fertilisers, bacteria, viruses, parasites like amoeba and contaminants like Nitrates, Fluorides, Iron, Manganese, Lead etc.

Spring Fresh, the Water Police, has recently introduced a wide range of water filters and purifiers which remove these water pollutants and contaminants to produce clean and healthy drinking water.

These products include: • **Commercial Water Purification Systems:** Commercial Reverse Osmosis Systems for production of Pure Water, Water Softeners, Water Filters, Iron Removers, Carbon Filters, Filters for Water Coolers, Ultra-Violet Water Sterilisers and Hot a Cold Water Dispense • **Drinking Wat Systems:** Non elect Water Purifier Contaminar Removers for remov of Lead, Fluoride Nitrates, Iron Manganese, Ultr Violet Water purifie Reverse Osmos Systems and Wat Dispensers.

The above systen are suitable for Hotel Restaurants, Resort Schools, College Mineral Wat Suppliers, Beverag Companies Alcoholic and No Alcoholic, Foo industry, Dairy Industry, Bakeries etc.

The Water Police is a truly internation police force with specialised componen from all over the world — USA, Europe Asia.

*For further details, contact:*

**Spring Fresh Water Treatments Limite**
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56 Nehru Place
New Delhi 110 019
Tel: 011-6419319, 6216239/7331/7345
Fax: 011-6464340
Email: infonet@giasdl01.vsnl.net.in
**Bangalore Off.:** Union Street
Shivaji Nagar
Bangalore 560 051
Tel: 2864151

## MILLI & MINI MILLI SCREENS

Johnson Filteration Systems are suppliers of Milli and Mini Milli screens, World Class Rotary Screens from USF/ Contra Shear, New Zealand Industry leader since 1976. • The Screens are Superior Solids Liquid Separators Unique Contra rotation for optimum shear velocity, single weir design for smooth presentation of influent to screen slots and accurate V-wire screen resulting in 96% solid recovery at greater than slot size and 50% at half the slot size • Discrete design sections within the screen and controlled fluid dynamics produces consistent de-watered solids • All wetted parts are of SS 304 Stainless Steel and reliable mechanical design which results in reliable service for long life • Self cleaning prevents biological build up for hygiene operation • Fully enclosed design eliminates product contamination and gives better aroma retention essential for food processing • Wide range Mini Milli Screens from 10 to 550 LPM and M Screens upto 56000 LPM.

*For further details, contact:*

**Johnson Filteration Systems India Lt**
Block No. 53, Nr. Khatraj Char Rasta
P.O. Vadsar, Taluka Kalol
Dist. Gandhinagar 382721
Tel: 2764-81220/81221/81440
Fax: 2764-81028
Email: sales@johnsonscreensindia.co
Website: www.johnsonscreensindia.co

## AUTOMATIC VACUUM FORMING MACHINE

Europack are manufacturers of best quality Automatic Vacuum Forming machines which are utilised in Food Products, Pharmaceuticals & Cosmetic.

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*For further details, contact:*

**Europack Machines (India) Priva Limited**
Akash Business Centre
CST Road
Kurla (W)
Mumbai 400 070
Tel: 6504909/ 6501856/6502710
Fax: 0091-22-6505368
Email: europack@vsnl.com
Website: www.europackmachines.co

# Bombay Industrial Engineers

13, Crystal Apartments,
Gulmohar Cross Road, 11 J.V. P.D.
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* Cloth Raising Machine
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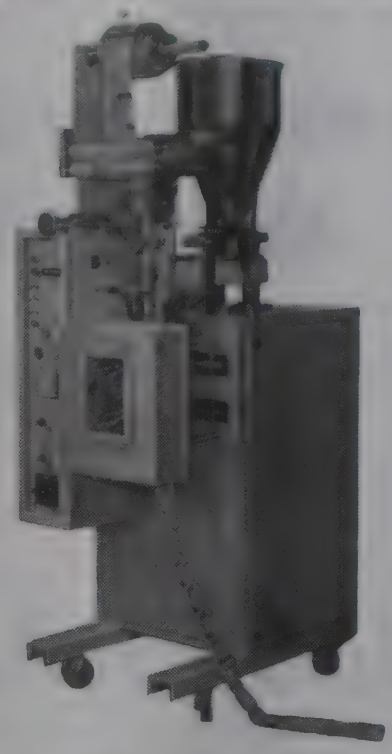
* Weighing Machines
* BOPP/Industrial Tapes Manufacturing Machine & Plant

GRIP ENGINEERS PACKAGING MACHINES
VERTICLE FORM/FILL/SEAL MACHINE



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Tel : (Resi.) 645 5103, 645 5079 C/o 821 8521

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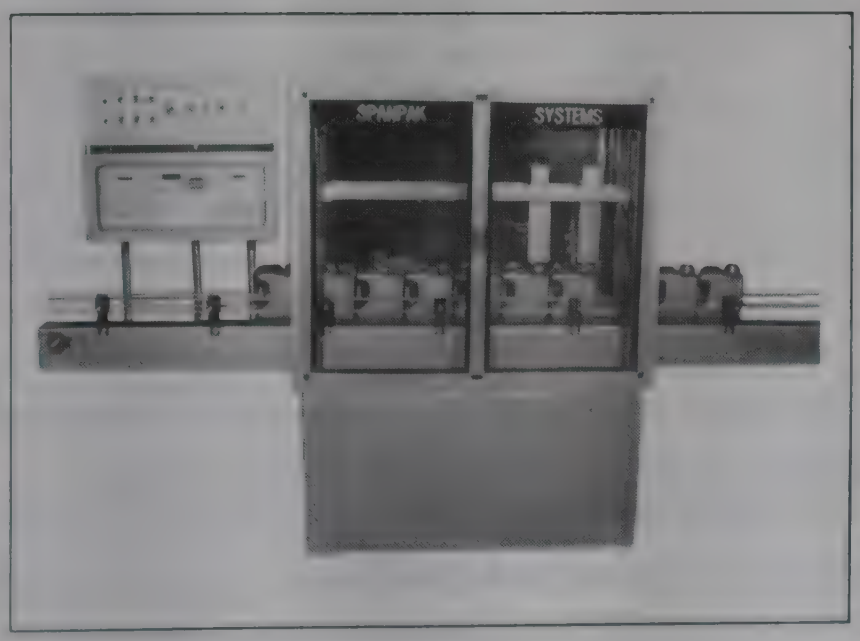
**SAFETY DEVICE**

Non-contact electronic sensors assure "no bottle no fill" status to avoid spillage in absence of container

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**AGUAPURO EQUIPMENT,** 2/22, Panwala Building, Dr. S.S. Rao Road, Lalbaug, Mumbai 400 012. Tel: 4101432/415 5576, Fax: (022) 415 5576, Mobile: 9821078929, Email: ID aguapuro@vsnl. com, Website: www.aquapuro.s5. com
**Products:** * Dosing Equipment * Multimedia Sand / Carbon Filters * Softeners / De-mineralisation Systems * Reverse Osmosis Systems * Micron Filters * Ozonators * Turnkey Project for mfg. Mineral / Pure Water for food & beverage application

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**Products:** * S.S. Filtration and Process Equipment for Pharmaceuticals, Chemicals, Foods & Beverages and Breweries Industries

**PARAG ENGINEERS,** B-7, Trimbakkar Estate, Street No.22, opp.• V.I.P. Co., Nr. Rota (India) Ltd., M.I.D.C. Andheri (E) Mumbai 400 093. Tel: 8234215/0738, Fax:8262291
**Products:** * Food/Beverage Lobe-Bump Pumps

**PRECIDOSE PUMPS & SYSTEMS,** 9, Deep Akruti, Near L.G. Hospital, Maninagar, Ahmedabad 380008. Telefax: 079-5830762, 5835056, 5893868, 5465653, Email: vbs@icenet.net
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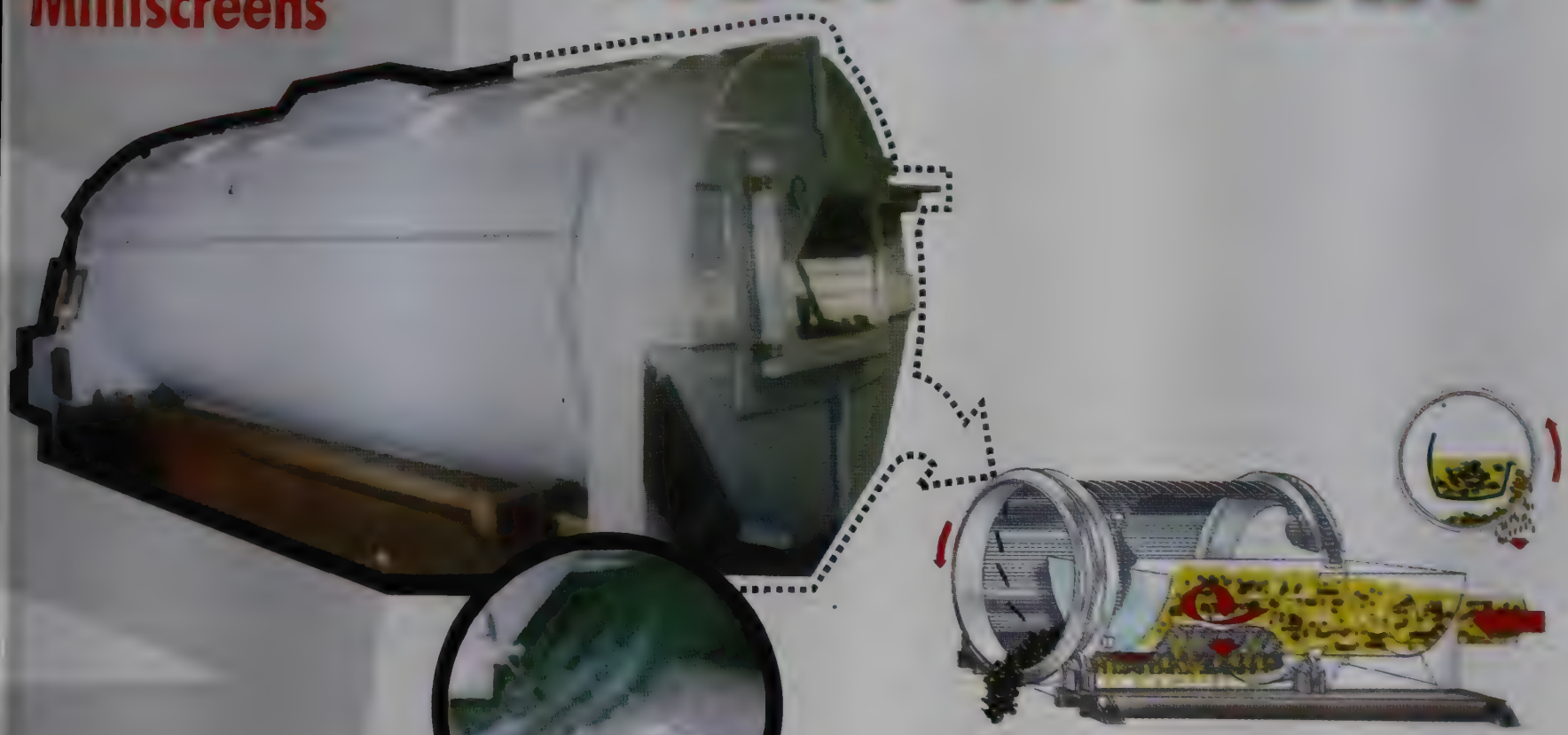

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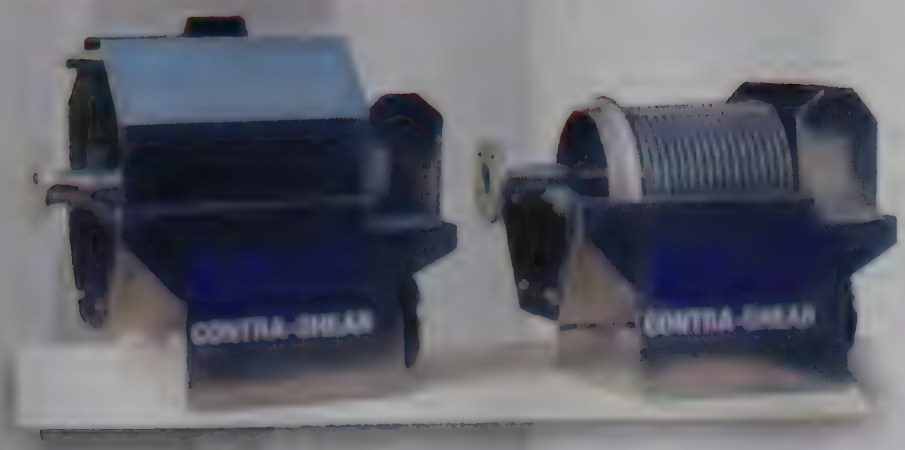


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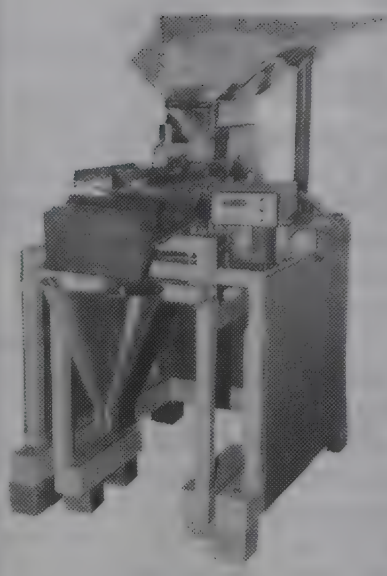

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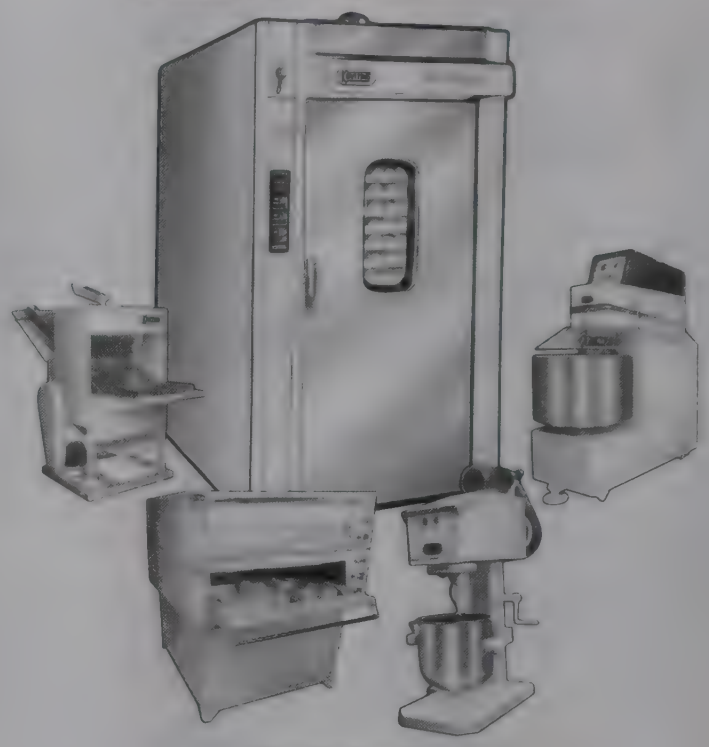

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# NEWS & NOTES

## VALUE ADDED PRODUCTS FROM TAMARIND

Scientists at the National Chemical Laboratory (NCL) in Pune have developed a process for the recovery of value added products from "tamarind" – a native Indian tree that is as common as neem.

NCL has filed four patents based on the know-how developed and has already been awarded a US patent No 5,994,533.

The tamarind fruit contains kernel, pulp and seed. Tamarind pulp contains around 13 percent tartaric acid (as a mixture of tartaric acid and potassium bitartarate), five percent pectin and 33 percent fruit sugar. All these belong to a group of products popularly known as neutraceuticals which is growing business worldwide.

Tartaric acid and potassium bitartarate are used in food, beverage and pharmaceuticals industry and they are presently isolated only from wine argold. Tamarind pulp provides the only other source for tartaric acid and potassium bitartarate. Pectin that also finds applications in food and drug industries is a plant polysaccharide traditionally recovered from citrus peels and apple pomace.

NCL process recovers potassium bitartarate, pectin and fruit sugar from tamarind pulp in a sequential manner. The bitartarate and pectin – whose composition is very similar to the high methoxyl apple pectin marketed commercially – meet pharmaceutical and food grade specification.

"Sugar isolated from tamarind pulp is a mixture of glucose and fructose and can be used as a substitute to invert sugar in confectionery and bakery industry and possibly in beverages.

The NCL process has been standardised on the bench scale and technical viability of the process based on the yields has been established, the scientists claim in their patent. The process, is able to recover 75 percent of potassium bitartarate, 50 percent of pectin and 85 percent of sugars present in the tamarind pulp. The pectin and sugar isolated, not only find commercial applications but help to make the process more competitive.

## WOES OF SURPLUS MILK

Increase in milk out put in Kerala has left Kerala Milk Marketing Federation (milma) neck deep in difficulties as it struggles to sell all the milk.

Milma was procuring approximately 8 lakh litres of milk a day, and struggled to achieve sales of 7 lakh litres a day. The remaining quantity is being converted to milk powder and other milk products. The situation has been made worse by an early beginning of the flush season. Milk output shows a sudden spurt in the flush season.

Adding to the woes, milk is flowing into Kerala from neighbouring states. A total of 29 milk brands are competing for the Kerala market, estimated at approximately 65 lakh litres per day. The competition has resulted in Milma holding surplus stocks of milk on a daily basis, which it has to convert into milk products.

Unfortunately for the federation, because the procurement prices in Kerala are higher than those paid by milk product manufacturers outside the state, it loses approximately Rs 4 per litre, post-conversion of the milk into milk products. At a rough estimate, the federation is losing about Rs 4 lakh a day on the 1 lakh litres it is forced to convert into milk products.

Kerala's urban milk consumption is estimated at about 15 lakh litres per day, of which Milma has a share of about 45 percent. But unlike private operators who procure milk from outside and sell in Kerala, Milma's spread is much lower. The excess supply of milk may even force Milma to cut down on procurement.


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## WATER-SOLUBLE PLASTIC BAGS

Ravi Iyer, the entrepreneur of a SSI unit, and his consultant A.V. Ramarav developed plastic bags of thickness ranging from eight to 20 microns, were degradable in weather and soil due to ultra violet radiation and also in water with no toxic contents. Producing certificates from the central institute for plastic engineering and technology, Chennai, and Sri Chitra Tirunal institute for medical sciences and technology (biomedical technology wing), Trivandrum, Kerala. The test results from the institutes showed that the carry bags lost their strength drastically in sunlight, water and soil. The degradation, could vary from place to place. But the product was totally degradable in about 60 to 90 days. However, this could be brought down further with a little more research

## CHINESE TEA

The Chinese fever seems to have gripped one and all. Now Chinese tea has filtered into the Indian tea industry with comfortable ease. The average price of Indian tea is around Rs 72 a Kg with growth rate rather sluggish. The Chinese tea is available anywhere between Rs 9 to Rs 16 a Kg. Though the tea is not up to the mark there are tea merchants who would not mind using small quantities in blends.

It is not that huge quantities of these Chinese teas will be imported by blenders. But even small quantities are enough to depress the sentiments already battered by the developments in the recent past. Tea imports from other than Sri Lanka attracts 70 percent duty. Even at this stiff rate, the Chinese tea would cost a pittance compared to its Indian cousin.

## MINIMUM QUALITY STANDARD FOR MALT-BASED FOOD

The government has amended the Prevention of Food Adulteration Rules 1955 to introduce minimum quality standards for malt-based food. The parameters proposed in the standards seek to ensure that the malt used in malt-based food is of high quality so that the quality of the end products is assured. It was felt necessary to introduce these minimum standards for these products in view of the fact that these products have wide consumer acceptability, particularly among children, pregnant women and elderly persons. The standards have been formulated after studying the various malt-based products in the domestic market.

## ISI CERTIFICATION FOR BOTTLED WATER

All brands of bottled water in the country will carry an ISI (Indian Standards Institute) mark awarded by the Bureau of Indian Standards (BIS), soon.

This is for the first time the government has laid down guidelines and standards for bottled water and the move has been welcomed by the recently formed All India Bottled Water Manufacturer's Association (AIBWMA).

The Rs 100 crore packaged water market in Mumbai will be greatly benefitted by the government order making ISI mark mandatory for all brands of bottled water. This will prevent unauthorised suppliers from selling their products.

By making the ISI mark compulsory for bottled water, the customer will get what he pays for and that is, good, clean and safe drinking water. With the ISI certification, the Food and Drugs Administration will be authorised to check the quality of water sold as packaged drinking water.

## SPICES HELP TO NERVE IMPULSES

Top nutritionist R.N. Devidar stated that spices used in most dishes not only impart flavour and aroma but also assist in transmission of nerve impulses.

Chemicals acetylcholine and its precursor choline are released when spices like cardamom, coriander and fennel seed are gently roasted and these chemicals form an integral part of all cells in human body particularly those of the nervous tissue as acetylcholine assists in transmission of nerve impulses.

Roasting either helps the chemicals to develop in the spice or releases them from their bound form. Almost all the spices have several non-nutritional benefits too. Fenugreek sees are known to lower blood glucose and blood cholesterol levels as they have large amounts of soluble fibres in them, thereby finding recommendation in many native remedies for diabetes. Ginger apart from being a good digestive, has compounds like gingerols and saogaols that relieve painful swelling and stiffness associated with arthritis.

Kashmiri cooking where fresh and dried ginger is used, indicating that they help to keep out the cold and pain from aching joints. Fresh ginger even though it is "hot" on the tongue, is also believed to protect the gut against the development of ulcers, gingerols in ginger may also play a role in preventing some cancers.

## POULTRY INDUSTRY

The National Egg Coordination Committee (NECC) and Poultry Federation of India are vehemently opposing the recent amendment for labelling of food products. The amendment in the food Adulteration Rules makes it mandatory for all manufacturers to make a clear declaration by using a symbol and colour code in the label and other information material, if the article of food contains wholly or partly of any animal including birds and fresh water or marine animals or eggs as an ingredient.

The poultry industry has also decided to take up the matter with the centre if the ministry of health refuses to consider their plea against the new rule, officials in the Poultry Federation of India stated.

The egg industry has been in the grip of bad times since the past few month and the industry also had to destroy large number of eggs due to low sale and stagnant demand.

Moreover, the Poultry Federation o India is highly opposed to the idea o labelling egg as non-vegetarian. Foo and its nature are strong emotive fac tors among certain sections of people

## WHISKY SALES INCREASE IN DELHI

The state government in Delhi ha lifted the fixed order stipulation for cheap medium and regular liquor brands in it excise policy. This will increase the sal of whisky brands like Gilbey Gree Label, 8 pm, Diplomat, Aristocra Haywards and many more.

As per the earlier stipulation, th liquor brands which are priced in th category Rs 90 Rs 200 could sell onl 0.1 percent of its total sales across th country in Delhi. However in this ne excise policy, the Delhi government ha decided to lift this cap and allow th vendors to stock any number of case of these brands.

This new rule along with the govern ment's decision to allow a few privat players to enter retailing, will increas the sale by about 20 to 25 percen Removal of the fixed ordering clause wi see the new brands growing by at leas 20-25 fold and the established bran growth by at least 10 fold.

## AUSTRALIAN APPLES FLOOD INDIAN MARKETS

The Indian Fruit market is now floode with apples from Australia.

Fruit traders selling domestic varie ties alleged underinvoicing by Austra ian fruit exporters, leading to a complet dumping of orthodox varieties" that ar not acceptable in western markets int Indian markets.

Traders reported that at least 15 forty-foot containers (FEUs) have a ready come through the Chennai po and another 25-30FEUs through Kolkat Port.

The Australian apples enter domes tic market in January after the domest season ends.

'Imported apples attract 50 perce basic duty plus 4 percent additiona surcharge. Thus 20 Kg boxes of Au tralian apples cost approximately R 1,400.

## ORGANIC SPICES

There is a growing shift in the deve oped world for organic food product The move towards convenience foo

has an impact on organic spices. Processed food can be labelled 'Organic' only if 95% of its ingredients originate from organic agriculture.

With increasing demand for organic spices in the global market there is a tremendous potential for exports if concentrated efforts are taken to promote their organic cultivation.

The global demand is expected to be 57,000 tonnes which is 10 percent of the conventional 5.7 lakh tonnes. Europe is an important organic market with a turnover of $ 5.6 millions.

India's share in the global market of organic spices is negligible, around 100 tonnes of black pepper and small quantities of white pepper, small cardomom, ginger, turmeric, mace, nutmeg and vanilla.

To further promote these products the spice board has initiated research programmes on organic cultivation of important spices.

## ALGAE CULTURE FACILITY

Plant located in Tuticorin district is commissioned jointly by Hyderabad Shantha Marine Biotechnologies Pvt. Ltd. and Chennai based ABL Biotechnologies for developing marine algae culture facility for production of vitamin 'A' precusors, based on complete indigenous technology.

The project envisages production of nutritional supplements such as beta carotenoids, the precursors of vitamin A and spray-dried algal products for the domestic and international markets.

Developed by ABL, it involved culturing of locally available strains of marine algae Dunaliella Salina which were capable of producing beta carotenoids. These would then be extracted and encapsulated for the markets. This completely natural source of vitamins would be cheaper than the synthetic and costlier ones available in the markets today.

The plant would produce 3,000-5,000 kg of 20 percent beta-carotenoids and 10,000-15,000 kg of spray-dried algal products.

ABL is a marine biotechnology-based research and developed company working on microbial metabolite-based biochemicals for use in nutrition, pharma, cosmetic and industrial intermediates.

## VITAMIN 'C'

A study was recently conducted in England on 20,000 individuals in the age group of 45 to 79 years showed that fruits and vegetables high in vitamin C are associated with a reduced risk of death from all causes including heart disease and stroke.

Even small increase in levels of vitamin C in the blood reduced the risk of heart disease and death in healthy adults. One extra serving of fruit or vegetable was associated with a 20 per cent lower risk of death from all causes regardless of age, blood pressure, cholesterol, smoking, diabetes and use of dietary supplements, findings have shown.

The risk of death was cut in half for individuals who had the highest levels of vitamin C in their blood compared with those who had the lowest levels. The report adds to a large body of evidence linking a vitamin C rich diet with better health and longer life and suggest that small dietary change could have a profound effect on health. As an antioxidant, the vitamin moves through the blood, mopping up DNA damaging free radical.

These compounds have been linked with chronic disease and aging. In other findings, high blood levels of vitamin C were associated with a decreased risk for cancer among men but not women. It may be that any possible protective effect of this dietary pattern is specific to particular cancers.


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# INTERNATIONAL NEWS

## INTERNATIONAL BREWERIES TURN TO WINE MANUFACTURING

With more and more consumers turning to wine, the world's top spirits giants, Diago and Allied Domecq., Australian brewers Foster's Brewering Group and Lion Nathan are turning to vineyards and wineries. Diageo, the Johnie Walker whisky and Smirnoff vodka company, is searching Australia, California and Chile. Allied has its focus on Australia and New Zealand, while France's Pernod Ricard is the only successful European company down under with its Jacob's Creek brand.

The bright spots for production are in the New World, with demand high for wine from Australia, Chile, the United States and South Africa. On the consumption side the growth areas are Britain and the United States, the top wine importers.

DIAGEO is eager to expand further in California and Australia and to cash in on the recent popularity of Chilean wines to add to its position as the world's top spirits group and major beer player with Guinness.

Allied's current wine interests are focused on the Unites States with Atlas Peak, Callaway and William Hill Winery brands.

## FIBERAID

FiberAid is a natural, highly soluble multifunctional food ingredient which exhibits properties such as low viscosity, cold water solubility, performance boosting of baked goods, food systems and fat free formulations, and offers high dietary fiber content, minimal impact on mouthfeel, minimal affertaste and reduced flatulation potential. It is also used in rheology and moisture control, low calorie film forming attributes, flavor encapsulation, Dietary fiber contribution. FiberAid when added to a nutritional beverage offers fiber enrichment at significant levels with minimal sensory impact.

## COCA COLA

Atlanta based Coca Cola, the world's largest soft drink company recently acquired mad River Traders a small US tea, juice and soft drink Company. Alternative drinks or functional beverages, as they are sometimes called, include bottled water, natural juices and teas laced with ginseng and other herbs. The market is estimated to be worth about US$ 5 billion annually.

Mad River sells ginseng-fortified Forbidden Fruit, Mountain Style Lemonade and other brands primarily to consumers in the North-East, Mid-Atlantic and North-West. Mad River brings a unique set of beverages to the Coca-Cola system that has tremendous potential to become a strong growth contributor and a value creating force in the industry.

It will launch a new B-vitamin fortified formula for its Powerade brand. The company is also introducing a vitamin-fortified, lower-calorie Powerade Light beverage. Powerade, which has been on the market for about a decade, has captured about 15 percent of the sports drink market.

Coca-Cola's new Powerade formula, featuring B3, B6 and B12 vitamins, apparently targets not only athletes, the traditional market for sports drinks, but also all those who engage in "intense workouts". The Powerade Light brand, which will be available in two blended-fruit flavors, will be marketed to those with an "on-the-go" lifestyle.

## PEPSICO INC.

Pepsico Inc.'s plans to acquire Quaker Oats Company, maker of Gatorade sports drink. The deal, will enable Pepsi to leverage Quaker Oats' Gatorade to gain undue advantage over other beverage manufacturers.

Share holders of both companies approved the deal. Quaker's Gatorade, the clear winner in the US sports drink market, would be a major boost to PepsiCo's lineup, adding almost 10 percent to the company's US drinks volume. PepsiCo plans to sell the tiny All Sport Line ahead of completing its acquision of Quaker. All Sport is in no way, shape or form a threat to Gatorade. Gatorade commanded a 78 percent share of US sports drink volume last year, while Coca-Cola Company's Powerade line controlled 15 percent of the market and All Sport had just a 4.4 percent share. PEPSICO launches Pepsi Limon, its cola drinks with a twist of lemon, in Mexico With the roll out of the lemon-flavoured cola, Pepsicola Mexicana will satisfy the Mexicans' love for lemon. The company hopes that the new drink will help bolster its current 18% market share of the cola sector in Mexico, the world's second biggest cola-drinking market. It estimates sales of 400 million units of Pepsi Limon in the first year. The drink will be marketed in cans, 600 ml and 2 litre PET bottles.

## INTERNATIONAL MARKETING FOR FRUIT JUICES

United Kingdom has become huge market for fruits & vegetable juices as its population seeks healtheir products with varied taste. This is a good opportunity for developing countries to export fruit juice & juice concentrate.

Currently, the United Kingdom is a net importer of fruit juices, with importers accounting for most of its requirements. In 1999, imports amounted to US$ 435 million, or 360,000 tonnes in volume terms.

Orange juice is the main juice product imported to the United Kingdom, with a 65% share by volume. Apple juice is the second largest import, accounting for 10% by volume, while pineapple juice, with 3% by volume, is the most significant singleflavour tropical juice import. Other tropical juices, concentrates and pulps are imported in lesser quantities. They figure more as contributors to mixed juice products rather than as single-flavour juices.

In recent years, juice drinks have been the main driver of growth. Growth in pure juices has come from chilled products. Growth in long-life, or ambient, pure juices is modest. Orange juice will remain the leader, followed by apple juice. In terms of tropical juices, pineapple is likely to retain or increase its share to some degree. Growth in other single-flavour tropical juices is likely to be modest. Better prospects for tropical juice products lie in their use in mixed juices and especially in juice drinks where manufacturers are increasingly looking for new flavours.

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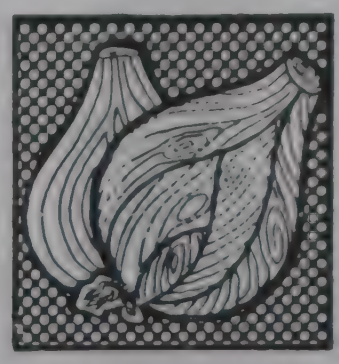

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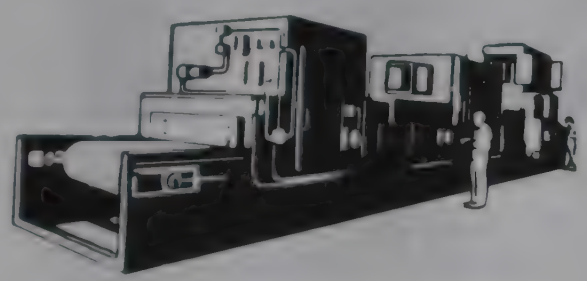

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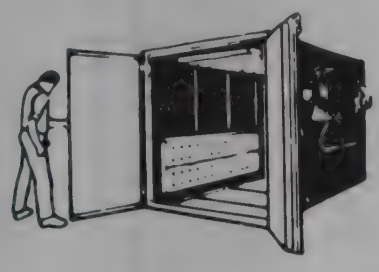

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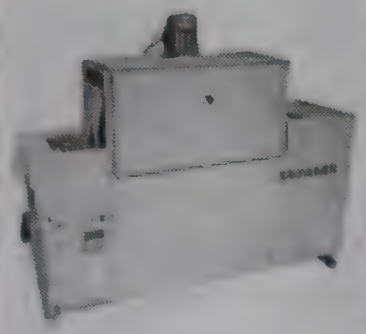

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# COMPANY NEWS

## VENKY'S INDIA

Venky's India a poultry major is all set to expand and upgrade its capacity of ready to cook chicken products. It also plans to introduce new curry-based ready-to-cook chicken dishes and other desi chicken products such as chicken kababs and tandooris.

The expansion plan, coupled with better realisation of chicken and lower maize prices, is expected to increase revenues by 25 per cent in the current year.

The company will provide all inputs to farmers, including medicines, and the feed, for day-old chicks and buy back the entire output which will be marketed under the Venky's brand name.

Currently, Venky's India breeds two lakh broiler chicks from inhouse facility per month and sells them either as dressed chicken, chicken kheema or boneless chicken, and also in the form of ready-to-eat chicken.

The processed chicken sale will increase to eight lakh broiler birds per month from two lakh birds per month once contract farming begins.

Venky's India is investing Rs 1.5 crore to upgrade and add balancing equipment to increase the capacity of the ready-to-eat chicken processing plant in Kamshet, near Pune.

Venky's is a dominant supplier of chicken products to Dominos Pizza, Pizza, Hut, Kentucky Fry Chicken and other fast-food restaurants.

## SEAGRAM'S

Seagram's Royal Stag Deluxe Whisky has sold over a million cases up to third quarter of last fiscal and hopes to cross 1.3 million cases mark.

Seagram, which entered the Indian market in September 1995 with Royal Stag, has emerged as the fastest growing deluxe whisky brand in the country. The company is overwhelmed by the brand's success, despite its "higest end consumer price". It's claim that it does not contain any artificial flavour was the single most factor that consumers appreciated. Over the last years, Royal Stag is said to have achieved a compounded annual growth of 55 percent. Enthused by the success, the company is now planning to enter into additional bottling tie-ups to make the product more available and increased market penetration.

Currently, it has signed up with three bottlers in Madhya Pradesh (Gwalior Distilleries), Andhra Pradesh (APMET) and Rajasthan (Allied Domecq). It already has two plants of its own at Daurala, UP and Nasik in Maharashtra.

The proposed bottling tie-ups will happen essentially in the south and the east. The south, especially Tamil Nadu, is a big volume market.

## SPA'KEL

Jukaso group company Spa'kel a regional brand in mineral water segment having a market share of around 15% in Maharashtra has embarked on all expansion plan. Spa'kel was the first company in India to introduce goblet/glass of mineral water. The company has invested Rs 2.5 crores for increasing the existing production capacity to meet the sales target of Rs 2 crore in the mineral water segment.

## GUJARAT COOPERATIVE MILK MKTG FEDERATION/HINDUSTAN LEVER

The stage is set for battle royal between the home grown challenger Gujarat Cooperative Milk Marketing Federation (GCMMF) and Hindustan Lever for becoming number one player in the icecream segment. GCMMF which markets 'Amul' brand products has grown sufficiently to match Hindustans Lever's commanding position of number one in icecream market. Amul is growing at a rapid pace but HLL'S sales have stagnated.

HLL's dominating market share of 50 percent, was built through acquisitions. It bought market leader Kwality, acquired Dollops from Cadbury and the Delhi-based Milk Food.

However, HLL seems to have been unable to build on this ever since. Figures from GCMMF suggest that the organised market for ice-creams is about 60 m litres, growing at 15-20 percent per annum. This makes Amul's share about 27 percent in volume terms for the last fiscal.

In its forward march, Amul has rapidly overtaken Vadilal, which was the second largest company till a few years ago.

Amul's Frostik, which sizes up against Feast of Kwality Walls, sells at Rs 15 compared to Rs 25 for Kwality Walls' Cornetto. In fact, Amul recently ran a promotion, where it was selling Tricone for Rs 10 only. Competition is hotting up in the price game, Amul has set its sights on becoming no 1 player in icecream segments.

## COCA COLA INDIA

Coca Cola India is making a strong bid to emerge as a dominant player in the bottled water segment.

Coca Cola is taking over the 20-litre packaged water business of Pune-based Thermax Culligan Water Technologies (TCWTL), a 50:50 JV between Thermax India and Culligan of the US formed four years ago.

The strategic deal will instead see Thermax Culligan withdrawing its 20-litre water brand, Good Water, from the market which will give Coca Cola's bottled water brand, Kinley, the advantage of using the 40,000 litre per day capacity plant of TCWTL at Taloja near Mumbai.

Good Water's institutional business is sought to be transferred to Kinley. This means that Kinley will get 1,600 bulk customers of TCWTL in Mumbai and Pune. Good Water has 25 percent market share in the 20-litre category which includes large business houses and institutions.

Company has decided to buyout or tie-up with strategic partners in all metro and minimetro cities of India in order to have a greater share in 20 litre water jar segment which is 40 percent of Rs 500 crore bottled water segment.

The company is also in the process of entering into an alliance with a Delhi manufacturer and has already tied up with Black Diamond Beverages, its franchisees in West Bengal, to launch all pack sizes of Kinley water in the East.

## ADANI WILMAR

Adani Wilmar manufacturer of refined edible oil under brand name "Fortune" is

an equal joint venture between India's Adani Exports and Singapore's Wilmar Trading having its edible oil refinery at Mundra in Gujarat.

The Mundra refinery currently has the capacity to process 600 tonnes of crude edible oil a day. Adani Wilmar mainly imports crude oils such as palm oil, soyoil, sunflower oil and mustard oil through Mundra port, developed by associate company Adani Ports.

Adani Wilmar, is planning to set up a new plant on the East coast to expand its market across the country. The company plans to invest about Rs 6000-7000 lakh in the new 600 tonnes-a-day edible oil refinery to be set up near Kakinada port the decision to set up a new refinery on the east coast would help the company market its branded edible oil products across the country.

## UB GROUP

The UB group will soon launch a new beer called London no 1 strong. It also plans to relaunch London Pilsner in a new packaging. There are also plans to launch niche brands of beer-Light Ice and Kingfisher Sport-targeted at the calorie conscious consumer. This brand had a strong market in Maharashtra.

In the wake of the government ban on liquor advertisements on popular media, UB has now chosen the most modern, techno-savvy and convenient medium. The company has introduced a new website.www.kingfishernetshop.com - which will help to boost the sales of Kingfisher in Mumbai market.

## SHENG HOLDINGS

Sheng Holdings a Singapore based company is searching for a joint venture partner to launch its brand of flavoured mineral water "Ice Cool". The company has 3 flavours of mineral water, Strawberry, Orange & Black Currant. Since mangoes are in plenty in India, the company plans to launch mango puddings in India and exporting mango puree from India. Their other products are tender cocconut juice & energy drinks.

## BHARAT STARCH

Recently Bharat Starch had sold its starch and citric acid divisions to English India Clays and Bilt Chemicals respectively and since there was no business left the company is finally going into liquidation.

For BILT Chemicals the take over of the citric acid plant in Gujarat will be a perfect fit as the company is planing expansions in the segment. Sources said the buyers would actually take over the liabilities of Bharat Starch.

The promoters had agreed to bring in Rs 35 crore as fresh equity to start operations in its 12,000 tonne citric acid plant in Vadodara. The plant has been shut down for the last two years due to lack of resources. About Rs. 60 crore was required to restart operations

## DABUR FOOD LTD.

Dabur Food Ltd., manufacturers of fruit based beverages are having expansion plans for its fruit juice brand "Real". The 1-litre packs of "Real" brand will now be available with a spin cap, developed in a joint venture with Tetrapack, apart from a six layered composite carton with double seal capping. Real is available now in five flavours, namely Orange, Mango, Pine Apple, Mixed Fruit and Tomato. The company is also price restructuring of Real variant due to upgraded packaging. The company is also entering the papad and pickle sector. Already four varieties of papads are test marketed i.e. Punjabi masala, Urad and two appalam flavours.

## CARLTON & UNITED BREWERIES

Carlton and United Breweries Ltd., of Australia the original manufacturer of 'Foster's Beer' had filed a suit against Indo-Agro Industries, also manufacturer of fruit beers bearing marks 'Frosters' and King Frosters on 325 ml and 640 ml bottles respectively, for carrying the letter 'F' on its bottle.

Carlton and United Breweries had registered its trade mark, Foster's along with the letter 'F' under the Trade and Merchandise Marks Act with effect from July 15,, 1993. Counsels for Carlton and United Breweries submitted that the packaging of the defendant's beer prima facie shows that he has deliberately copied the plaintiff's trade mark and is thus guilty of passing off its goods as those belonging to the plaintiff.

After hearing the matter the Delhi High Court granted an exparte ad interim injunction against Indo-Agro Industries manufacturer of countefeit Foster's beer.

## HINDUSTAN LEVER LTD.

Hindustan Lever Ltd. (HLL) has launched atta targeted at the low end segment, under the brand name Kissan Annapurna. HLL is currently testmarketing the new product in Kerala. Kissan Annapurna atta has sales of around Rs 70 to Rs 80 crore and is the leader in its category.

HLL had said it is foraying into the fruits and vegetables categories which will be sold under one of its existing foo brands like Kissan Annapurna, Lipton Modern.

As part of its expansion plans, HL has re-entered the spices market unde the Kissan brand name. Earlier, it had presence in spices with its Sona brand The brand was then under Brooke Bon India, which was a separate group com pany along with HLL and Lipton India The spices market is estimated to b around Rs. 10,000 crore of which th branded market is only Rs 600 crore HLL will face tough competition fro established regional players in the mar ket.

## MODERN FOOD INDUSTRIES (INDIA) LTD.

Modern Food Industries (India) Ltd will soon launch new nutro biscuit an glucose biscuit in the commercial ma ket, in addition to developing crum biscuit formulations. Modern Food In dustries (India) Ltd.'s research and de velopment (R&D) department ha evolved formulation and guidelines fo launching Modern Milk Classic Brea They have also developed the use bread crumb in the development of swee rusk and milk sweet rusk for comme cial market and high fibre whole whea bread (brown bread with 100 per cen atta). Improvement in the quality existing cake varieties specially choco late cake, Nutro Biscuit and Glucos Biscuit for commercial market.

This will enable the company to con solidate its product mix and gain th much needed competitive edge in th commercial market. It aims a developming new products to move fu ther in the direction of product diversif cation and cost efficiency.

Chalking out the future plan of actio the company said it will look at develop ment of new varieties of bakery pro ucts and identification of more and mo cost-effective bread improvers for im proving the quality of bread.

The total size of the bread market Rs 1,800 crore. In the organised seg ment, Modern Bread is the leader with market share of about 7 per cent.

## NAMITA AGRO FOODS PVT. LTD.

Namita Agro Foods Pvt. Ltd., ha State of the Mineral Water Bottling Un at Shirwal District, Satara.

Bureau of Indian Standards ha awarded the IS: 14543 mark for th product bottled by them.

The plant has the capacity to bott approximately 24 lakh bottles per mon and has in house automated bottle blow ing and filling line for bottle sizes rangi

from 0.5 litres to 5.0 litres. The plant is located in the midst of Sahyadri rang of western Ghats in pollution free environment and has the best water treatment facility and the water is filled in most hygienic conditions in isolated, totally aseptic room. The plant also automated 20 litre returnable jar filling line. It has very sophisticated laboratory for analysis and monitoring of water quality exceeding the standards of bureau of Indian Standards.

The plant is well accepted by major Mineral Water bottling companies. It had bottled for United Breweries and Arbindo Liquors Ltd. Presently, Namita Agro Foods Pvt. Ltd. is Franchise bottling its entire production for Parle Bisleri Ltd., Mumbai.

Company has plans to invest further in this project and enter the growing beverage market. The diversification plans include packaging of Club Soda & Ready to Serve Juice. The company also is exploring the possibility of catering to the export market.

## BRITANNIA

Britannia acquired the Kwality Biscuits' trademark 'Kwality', the 'Chef' symbol and several other trademarks owned by the Bangalore-based company for a consideration of Rs 30 crore. Kwality is an important regional player and the brand offers Britannia the opportunity to strengthen its position in terms of share and possible extensions. However it was made clear that Britannia will not use the Kwality brand name for any of its existing brands. As things stand, Britannia and Kwality will maintain their separate identities.

Kwality, has only one manufacturing plant in Bangalore and Britannia Industries will explore the possibility of using Kwality's Bangalore facility for manufacture of its products after acquiring 49 percent stake in the regional biscuit major.

## DEMERARA DISTILLERS

In the wake of lifting of quantitative restriction by the government of India South America Liquor major, Demeraro Distillers has decided to enter the Indian market. Demerara Distillers is one of the world leading distiller known for its wide range of rums. The company is the sole producer of the world famous Demerara Rums. It is currently the largest supplier of bulk rum from the Caribbean, exporting over seven million litre annually to the rum brand owners in the European community. It is also a major supplier to the US and Canada.

Demerara Distillers is currently scouting the Indian market for joint venture partner to undertake the business of import and wholesale of liquors like rum, whisky, gin, liqueurs, vodka, fruit juices, wines and ready-to-drink canned cocktails.

## CARE INDIA

India is a GM-free country. GM crops are neither allowed to be cultivated nor imported in any form. Care India an International voluntary organisation has been accused of bringing genetically modified food in the country clandestinely and supplying it under the Intergrated Child Development Services. The case against Care-India has been brought about by Gene Campaign, a ginger group working for preservation of bio-resources. Gene Campaign asks for stringent action against Care-India for deliberate contravention of Indian Law.

## NUCHEM WEIR

The Delhi based packaged water company Nuchem Weir will soon withdraw its brand 'Kristal' in the 20 litre packaged water segment due to its strategic alliance with Coca-Cola. The arrangement will see Nuchem Weir bottling Kinley at its Faridabad plant. The Faridabad plant has a capacity to bottle 40,000 litres of water every day.

With the 2,500 bulk customers transferred to Kinley, the bottled water brand from Coca-Cola stable will immediately notch up 15 percent market share in the 20-litre category.

Coke's new strategic alliance in the capital comes close on the heels of the MNC taking over the packaged water business of Thermax Culligan - which had earlier taken over the Good Water brand. The new alliance is expected to expand the Kinley brand in the institutional category in the western market.

It is believed that Coke is in a mad rush to gain a foothold in the 20-litre bottled water category as the segment is understood to be recording highest growth. The 20-litre brands put together corners 40 percent of the Rs 500 crore market.

## GROUPE DANONE/BISLERI

The French Food company "Groupe Danone" is all set to pick up a majority stake in Bisleri, the largest selling bottled water brand in the country.

When the deal goes through, Danone will not only be the new kid on the block, but a pretty hulking kid. With


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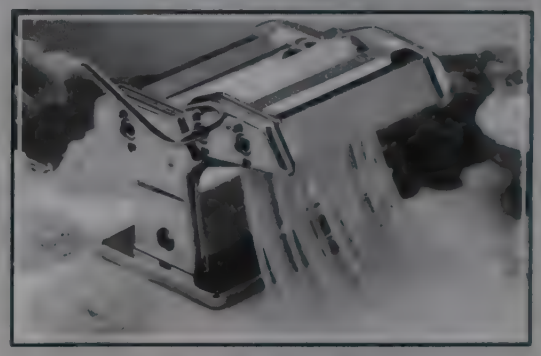

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Bisleri in its bag, the French major will corner a major market share in bottled water. Danone is already present in the upper-end market segment with brands like Ferra Relle and Evian. It has been looking for a mass market product for a long time and the acquisition would make the company the market leader in one stroke.

The bottled water market is in a boom phase, with MNCs like Nestle (Perrier and Pure Life), Coke (Kinley) and Pepsi (Aquafina) jostling for shelf space. This struggle can only get more intense if Danone enters the fray with Bisleri.

## ALLIED DOMECQ

Allied Domecq and its joint venture partner Wine (India) have decided to hike its state in Clan Morgan from 50 percent to seventy four percent. The company was incorporated in 1994 with the launch of its flagship brand - Teacher's and Teacher's 50. It started manufacturing from distilleries owned by Jagatjit Industries and has 1 50:50 joint venture with the same. Further, with the quantitative restrictions lifted recently, the company intends importing four of its core international brands into the country. These brands are Valentine (a whisky), Beefeater Gin, Kalua (Coffee liqueur) and Courvoisier (a cognac).

With the lifting of Quantitative Restriction by the Indian government, the second largest spirits company in the world, Allied Domecq, is all set to titillate the taste buds of connoisseurs in India with its range of coffee liqueurs Tia Maria and Kahlu cocktails which will soon be followed by the launch of its premium scotch whisky Ballantine's and gin Beefeater.

Allied's brand portfolio currently includes Teacher's scotch and Old Smuggler scotch apart from Old Smuggler rum and gin.

Beefeater premium gin, claimed to be the only genuine London Dry Gin made in London, could cost between Rs 1,600 and Rs 2,000 a bottle while Allied's exotic coffee liqueurs Tia Maria and Kahlza may cost anything beyond Rs 3,000 a bottle.

Kahlza, made from the Arabica coffee bean which is comibined with cane spirit to create its unique taste, is one of Allied Domecq's most successful brands, being the second largest selling liquer in the world. One of the reasons for the fast sales of Kahlua has been the 200 ml bottles of its cocktail range Mudslide, B52, Kahlu Milk, White Russian, Toasted Almond and Bushwacker that are marketed as the "drinks to go" range

Allied Domecq hopes to post a turnover of Rs 85 crore during the current year.

## AITKEN SPENCE & CO.

Aitken Spence & Co., the Sri Lankan conglomerate operating in five sectors, is launching its packet tea "Ceylon Choice Tea" in India.

Ceylon Choice Tea is grown in the Elpitiya Plantations located in the high, mid and low elevations of Sri Lanka. Ceylon Choice is the flagship brand of Elpitiya Plantations, which comprises 15 estates covering 9,000 ha.

Ceylon Choice Tea is available in three variants – premium, popular and dust pearl. The 100 gm pack of Ceylon Choice Tea costs Rs 22, while the 250 gm pack costs Rs 58. Tea accounts for 20 percent of Aitken Spence's turnover. About 15 percent of its 8 million kg tea production is sold in Sri Lanka, while the rest is exported.

## INERTIA INDUSTRIES/MILLENNIUM ALCOBEV

UB Group has recently acquired 51 percent stake in Inertia Industries and will not be merged with UB Group as planned earlier. Millennium Alcobev will now be transferring its beer brands, human resources and assets to Inertia Industries, and hence remain just a shell company. The transfer to Inertia will be completed within two months, and Inertia will be renamed Millennium Alcobev.

The new company will be a stand alone company and will add value to the UB group.

The acquisition brought into its fold two more beer brands, Sandpiper and Turbo, along with Inertia's brewing capacities in Aurangabad (Maharashtra) and Daru Hera (Haryana).

The company has recently relaunched Sandpiper and has changed its image in terms of a new logo and packaging giving it a young, trendy and modern look. Sandpiper is positioned and priced at par against UB group's flagship brand Kingfisher.

Millennium Alcobev has five brands from the UB stable which includes Bullet, Charger, Kalyani Black Label Strong, Flying Horse and Sun Lager with an option to buy them. It also acquired the rights to market the brand Guru of Mohan Goldwater and its own brand Zingaro.

## UB GROUP

Kingfisher the Flagship brand of UB Group normally restricted to Indian restaurants in UK has now expanded its reach. It has become a significant niche brand in the country and has hit the top line retail chains in UK.

With the number of Britons frequenting these Indian restaurants increasing gradually, the availability of Kingfisher in such joints has also gone up. "This is despite the fact that Kingfisher is more expensive than Carlsberg in the UK".

UB sells about 1m cases of Kingfisher in the UK. The new stream of sales is expected to generate an additional 15 percent of sales revenues. Spreading itself out in the mass market Kingfisher will now be in direct competition with the top brands, primarily Carlsberg.

Kingfishers expectations are high on the UK market. The British, show great fondness for beer. Kingfisher's advantage in the UK is the shift towards premium lagers with non-lager beers that is, the UK's traditional ales, stout and bitter are losing market share to lager every year.

## BACARDI-MARTINI INDIA

Bacardi Martini India after registering a growth of 30 percent it now offers "Bacardi Lemon." The launch of the new citrus variation is part of the marketing gambit to reinforce the brand image with style and take on competition from Smirnoff of International Distillers. This new product is priced at Rs 474 for a 750 ml bottle, will be initially available in Mumbai, Bangalore and Kolkata. Thereafter it will be extended to other cities.

In India, the brand will be manufactured in Nanjangud, Karnataka. Bacardi's popular white rum Bacardi Carta Blanca is positioned against Smirnoff. While spirits constitute about 2 per cent of the total spirit market in India. The company expanded with its second brand, premium dark rum Bacardi Reserve, in the Indian Market.

Bacardi-Martini has also entered into a marketing alliance with William Grant & Sons to market its popular scotch whiskies, William Grant Family Reserve and Glenfiddich Single Malt in the Indian market.

Apart from its three own brands Bacardi, which has a 51 per cent stake in Whyte & Mackey India will now market other brands, including Whitehall Genesis and Royal Peg in India

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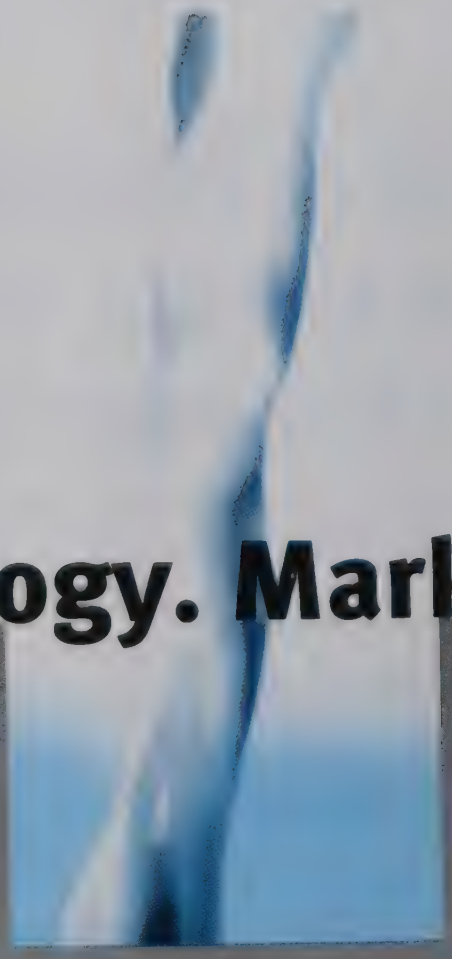

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# 3 International DAIRY & FOOD TECHNOLOGY EXPO 2001

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# INDIAN
# TRADE FAIRS & CONFERENCES

**AGRI INTEX 2001**
**Venue: Coimbatore, Tamil Nadu**
**Date: 1-5 August, 2001**

Organised by Tamil Nadu Agricultural University in collaboration with Coimbatore District Small Industries Association (CODISSIA) the biggest Association of its kind in the country enjoying support of over 4000 industries it is an international agricultural exhibition. Agri Intex 2001 aims to highlight development, growth and opportunities in modern agriculture and all the related activities of rural, national and global nature.

AGRI INTEX 2001 will be the meeting point for the lead players in their respective fields to launch and market their products, technologies, expertise and services through interaction with large variety of domestic and international participants and visitors.

Coimbatore finds a prominent place in the industrial and agricultural, progressive engineering, modern textiles, professional education and research institutions.

*For more details contact:*

**Agri Intex 2001, CODISSIA TRADE FAIR COMPLEX G.V. Fair Grounds, Avinashi Road, Coimbatore 641014. Tel: 91-422-593505, 593507, Fax: 91-422-593506 Email: cointec@vnsl. com**

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**3RD IDFT EXPO 2001**
**Venue: World Trade Centre, Mumbai**
**Date: 21-24 November, 2001**

2nd IDFT Expo held from October 3-6, 2000 at Pragati Maidan, New Delhi was hailed as a grand success by decision makers, dignitaries, industry leaders, Scientists, diplomats, media, students, farmers and others. The Expo drew large number of business visitors, scientists, farmers, etc.

Excellent business results were reported by the participants, quite a few joint venture proposals were initiated and long term business transactions were generated.

The 3rd IDFT Expo is being organised jointly with KML, Germany, the largest trade fairs organiser on agriculture in Europe and by DLG-German Agricultural Society, Germany.

The Co-sponsorer are All India Food Processors' Association, All India Ice Cream Manufacturers' Association, All India Bread Manufacturers' Association and Federation of Biscuit Manufacturers of India.

High power German Government and Trade delegation have planned to visit the Expo. Germany will put up a national pavilion displaying the technological and innovative advances made by food processing and dairy industries of their country.

Australia, Belgium, France, Italy, Japan, Switzerland, The Netherlands, Taiwan, U.K., USA and host India are planning their appropriate participation.

Satellite Programmes like Technical Seminars on Dairy and Food Processing Industries have been planned. Leading experts from overseas and India would be addressing the visiters and delegates from over seas and neighbouring countries.

Liberalisation and globalisation of economy makes India a very attractive and profitable destination for overseas business community and in this context the Expo offers huge potential for:

Joint ventures, Investment, Export and Import tie-ups, tie-ups for latest technologies and practices, State-of-the-art equipment and machinery, Technical consultancy, Business tie-ups, Promotion of corporate image, Promotion of products, Opportunities for one-to-one meeting and with trade delegations

*For more details contact:*

**3rd IDFT Expo 2001, 3rd International Dairy & Food Technology Expo 2001, November 21-24, 2001., World Trade Centre, Mumbai.**

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**FOODPRO 2001**
**Venue: Chennai**
**Date: 8-11 December, 2001**

India is already the world's second largest food producer and has the potential to be the world's number one. The growth potential of the industry is enormous. Food production is expected to double in the next 7 to 8 years and the consumption of value added foods are expected to treble from the current levels. The rapidly changing food habits has further opened up the market for Processed & Packaged Foods.

Organised by Confederation of Indian Industry (CII) FoodPro 2001 – India's Flagship & Premier Food Business Event is a comprehensive business fair featuring a 4 Day International Exhibition & Conference on Food Industry, and will highlight and showcase the tremendous opportunities across the entire Agricultures, Food and Dairy Chain.

Spanning the entire food chain from Farmers to Agro Producers to Processors to Technology Solution Providers to Retailers to the Consumers, FoodPro 2001 will cover the entire spectrum of Products, Equipments, Technologies, Solutions, Services, etc in the Agro, Food, Dairy and related businesses.

**FoodPro 2001 – The Highlights:**
• 4-Day International Exhibition • Conferences & Investment Seminars • Technical Sessions & Technology Forums • Parallel Events & Food Festivals • Exclusive State Government Pavilion • 150 + Exhibitors representing Agro, Food, Dairy and related Businesses.

**FoodPro 2001 Sectors:** • Food & Food Processing, Dairy, Poultry, Fruits and Vegetables, Meat & Marine, Bakery and Confectionery.

**FoodPro 2001 – Opening Markets:** Market opportunities across the entire Agri/Food chain by way of Investments, Joint Ventures; Technology Transfers with Indian Companies or Exporting to India for • Modernisation of the Food Chain • Agri-Inputs (High Yielding Seeds, Processing Varieties) • Agriculture (Farming Techniques, Inputs, Basic Mechanism) • Procurement & Storage (Material Handling, Packaging, Cold Chains, Transportation, Grading Systems) • Processing (Large Scale Facilities, Processing and Packaging Machinery & Technologies) • Retailing (Cold Chains, Retail Outlets) • Exports of Food & Agricultural Products including Processed & Packaged Foods.

**FoodPro 2001 Exhibition – The Marketing Event for you:** The FoodPro 2001 Exhibition will feature a wide range of Technologies, Equipments & Machinery for Processing, Manufacturing,

Refrigeration, Packaging of Food, Dairy, Agro & Related products. Also on show, will be a wide range of Agro and Dairy Products as well as Packaged & Processed Foods.

The FoodPro 2001 Exhibition will attract all the players in the Agriculture, Food, Dairy Businesses from all over India including Food Processors, Retail Chains, Hotel & Restaurants, Importers who would be using the Exhibition as a forum to source new Technologies, Equipments, Packaged & Processed Food and Dairy Products as well as fresh agro producers.

The FoodPro 2001 Exhibition will feature a wide range of Technologies, Equipments & Machinery for processing, manufacturing, refrigeration, packaging of food, dairy, agro and related products. Also on show, will be a wide range of Agro and Dairy Products as well as Packaged & Processed Foods.

**Scope of the Exhibition:** Technologies, Products, Equipments, Machinery, Applications, Solutions, Ingredients, Materials, Services, Tools, etc. for Processing, Production, Manufacturing, Storage, Handling, Refrigeration, Vending/Dispensing, Maintenance, Quality Control, Coding, Printing, Packaging & Retailing of • Food • Beverage • Horticulture • Agri Commodities & Products • Dairy Poultry/Meat • Bakery & Confectionery.

**Exhibition Profile:** Technologies, Equipments & Systems: Food Processing Equipment, Preservation Systems, Refrigeration Technology, Packaging Systems, Beverages, Processed Frozen Foods, Dairy Equipment & Technology, Dairy Products, Poultry Equipment and Technology, Poultry Products, Automation & Control Systems for Food Processing Equipments, Printing & Packaging, Storage and Handling Asceptic Facilities.

**Food Products:** Processed & Frozen Foods, Packaged Foods, Beverages – Tea, Coffee, Alcoholic & Non-Alcoholic Beverages. Dairy Products – Milk, Butter, Ice Cream, Cheese, etc., Horticulture Products.

**FoodPro 2001 Conferences:** CII will be organising a host of International Seminars and Conferences in areas such as bio-technology, water management, food processing, livestock, cold chain technologies, IT & agriculture, agri-infrastructure, agro-packaging, WTO & agriculture and food laws.

**Brand New Exhibition Venue:** The FoodPro 2001 Exhibition will, for the first time, be held at the ITPO Chennai Trade Centre – the Region's largest as well as Newest Exhibition Centre. The Exhibition Centre is easily accessible and is within the city limits. The fully air-conditioned exhibition venue boasts of a host of facilities.

*For more details contact:*

**Confederation of Indian Industry, Business Fairs Division, 35/1, Abiramapuram, 3rd Street, Alwarpet, Chennai 600 018., Tel: 0091-044-4987648, 466 0571, 466 0291, 466 0773, Fax: 0091-044-466 0312, Email: j.shanker@clionline.org / v.kuppuswamy@clionline.org**

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# INTERNATIONAL
# TRADE FAIRS & CONFERENCES

**PRINT + PACK EXPO 2001**
**Venue: Hong Kong**
**Date: 29th Aug. - 1st Sept., 2001**

Organised by Business and Industrial Trade Fairs Ltd., Print + Pack Expo 2001 is the largest and most sophisticated exhibition for printing and packaging industry being held regularly for the last fifteen years.

Print + Pack Expo is dedicated to the prosperous printing and packaging industries in Asia. It aims to bring together the world's latest technologies for the Asian printing and packaging market and will be the best market place for international suppliers and buyers.

Over 26,000 international visitors are expected from 34 countries at the exhibition.

**Exhibits:** Pre-press and post-press technology, printing machinery and materials, industrial printing machinery, screen/pad/hot-stamp printing, printing services, paper converting, binding equipment, packaging machinery and materials, and ancillary equipment, signs and sign making equipment, accessories and substrates, graphic arts software, desktop publishing technology, CTP, DTP, electronic and multimedia publishing technologies, flexographic printing supplies, printing materials and accessories, etc.

*For more details contact:*

**Unit 1223, HITEC, 1 Trademart Drive, Kowloon Bay, Hong Kong, Tel: 852-2865 2633, Fax: 852-2866 1770, 2866 2076, Email: enquiry@bitf.com.hk**

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**DRINKTEC - INTERBRAU 2001**
**Venue: Munich**
**Date: 20-27 September, 2001**

Drinktec - Interbrau 2001 is the world's largest fair for beverage technology featuring latest technology for manufacturing, bottling and packaging beverages of all kinds through to liquid foods.

The exhibition will present innovative beverage filling technology and innovative packaging solutions. It will also reflect the growing significance of non-alcoholic drinks, their world wide markets and the technology to serve these markets. All the latest technologies in manufacture, bottling and packaging of drinks of all kinds, through to liquid food, will be presented at drinktec-interbrau 2001. Entire systems and large-scale machinery will be set up at the fair, and demonstrate in action, so that visitors can experience close-up performance capabilities of the manufacturers.

**The Product range spans the entire repertory of the beverages industry:** The product ranges exhibited at drinktec-interbrau cover the entire spectrum of beverages technology. The key areas are: • Machinery and plant for malting and beer production and for the manufacture of alcoholic and non-alcoholic drinks • Filling and packaging machinery and labelling, storage, consignment and transport technology • Filtration and separation technology, measurement technology, process automation and control technology • Automation and new software solutions for all manufacturing and business processes • Packing materials and packing aids • Energy and water supplies, raw materials and raw material products • Fittings for hotels and restaurants.

*For more details contact:*

**Messe Munchen GmbH, Projektleitung drinktec interbrau, Messegelande, D-81823 Munchen, Tel: (4989) 949-20111 / 20112 / 20113, Fax: (4989) 949-20119**

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**LABEL EXPO EUROPE 2001**
**Venue: Brussels**
**Date: 26-29 September, 2001**

Organised by Tarsus Martex a part of Tarsus group Plc, the Label Expo Europe 2001 will be showcasing new developments in narrow web printing including flexible packaging folding cartons and digital printing.

Among the many new highlights of Labelexpo Europe 2001 will be the 'visitor trails'. The marked trails will be used to direct visitors to the stands for flexible packaging, folding cartons, digital solutions, labelling solutions and converting solutions. This will make it easier for visitors to find their way around this extensive event.

About 390 companies are expected to take part in this event.

*For more details contact:*

**Gillian Pattison, Press Officer., Tel: 44(0)20 8846 2700, Email: gpattison@tarsus.co.uk, Joanne Watts, Press Officer., Tel: 44(0)20 8846 2743, Email jwatts@tarsus.co.uk**

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**ANUGA - 2001**
**Venue: Cologne, Germany**
**Date: 13th - 17th Oct., 2001**

Anuga 2001 is the world larges trade fair for food and drink industry The product spectrum at Anuga wit Anuga Spezial offers suppliers an visitors an overview of the interna tional food sector.

Over 40 Indian companies are ex pected to take part in Anuga. A larg number of Indian businessmen fro states of Maharashtra, Delhi, Tam Nadu, Kerala, Karnataka, Punjab, Wes Bengal and Assam will visit the fair t explore new business avenues. In or der to improve India's export pros pects, India Trade Promotion Organi sation will be putting up an India Pavilion to showcase exclusive India products such as spices, cashew nuts tea and coffee, marine products a well as processed food items.

Over 6000 suppliers from 100 coun tries will be on hand at Anuga t exhibit a unique range of product covering almost all areas of the foo and drinks industry. Over 2 lakhs visi tors are expected from 152 countries The fair will also showcase the lates technology and services for the gro cery trade, the catering sector and th vending trade.

Discussions, presentations an workshops offered in the supportin programme will all be oriented toward current trends and topics in the indus try, exotic influences are having substantial impact on current foo trends for Indian business, Anuga the perfect place to establish vit contacts with business partners aroun the world.

*For more details contact:*

**Indo-German Chamber of Com merce, Maker Towers 'E', 1st Floo Cuffe Parade, Mumbai 400 005. Te +91-22-2186131 (9 Lines), Fax: +9 22-2180523, Email: igcc@giasbm0 vsnl.net.in**

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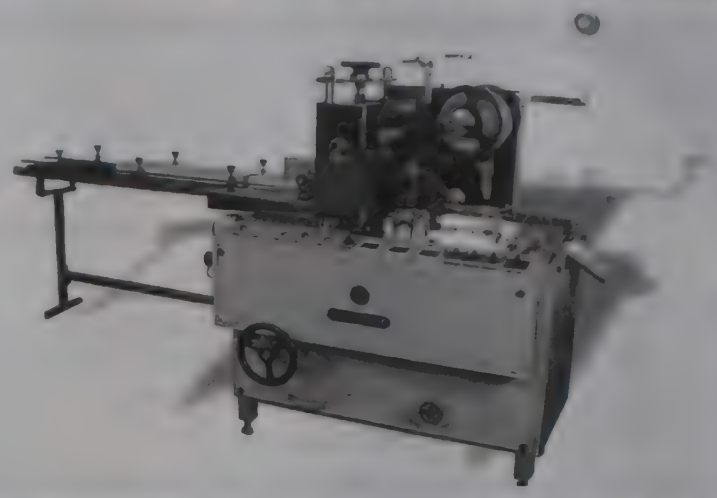
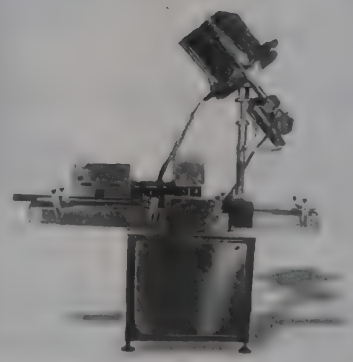
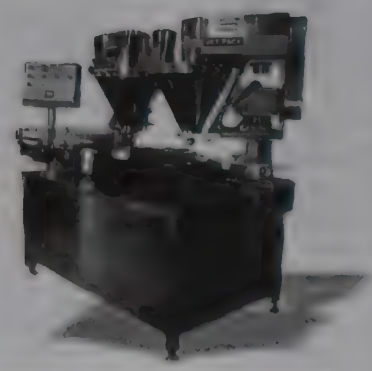


Food Products cartons premixes cartons overwrapping M/c.



Cap Pressing Machine

Cream Paste Filling Machine



Semi Automatic & Automatic Powder, Spices & Masala Filling

## Other Ranges of Machines from JET PACK

- Powder Filling Machine
- Cream Filling Machine
- Volumetric Cupfiller
- Liquid Filling Machine
- Capping Machine
- Rotary Sealing Machine
- Automatic Carton Over Wrapping Machine
- Horizontal Flow Wrapping Machine
- Neck Sleeving Machine
- Aluminium Foil Sealing Machine
- Automatic Coding Machine
- Insert Pressing and Sealing Machine

**For Details Contact**

**JET PACK MACHINES**

C-18, Nandjyot Indl Estate, Safed Pool, Kurla-Andheri Rd, Sakinaka, Mumbai - 400 072. Tel: 851 6489 / 851 5561 / 856 0800
Fax: 851 6489 Email: jetpack@vsnl.com

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- Lucid International Pvt. Ltd.
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**GUARGUMS, MODIFIED & DERIVATISED GUARGUMS, HYDROCOLLOIDS BLENDS AND STABILISERS FOR FOOD, FEED AND PHARMACEUTICAL APPLICATION EDICOL ™, STAMULCOL ™, LUCTOMAN ™, PECTOLUC (PECTIN), XANOLUC (XANTHAN GUM), SORBILUC (SORBIC ACID), SODIUM CARBOXYMETHYL CELLULOSE (CMC)**

## Solutions for the Food Industry...

- ➤ Gelling, Binding, Viscosifying / Thickening
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- Guar Gums, Stabilisers and functional blends, Stamulcol®, Luctoman
- Xanthan Gum (USP/NF, Food, Technical, Clear)
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- Citric Acid (Mono and Anhydrous)
- Calcium Citrate
- CITROCOATA® - (Encapsulated Citric Acid - Oil /Water soluble)
- ESSICCUM® - (Dry Vinegar Flavour)
- CITROFOL® - (Citric Acid Esters)
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- Carrageenan's - Food, Feed (Gelacrin® Seagel® Novagel® Avicel® Nutricol® Seakem® Viscarin®)
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- Torula Yeast (Inactive Yeast for flavour/nutrition)
- Alginates - Sodium, Calcium, Propylene Glycol
- Sodium Carboxy Methyl Cellulose (CMC)
- Sodium Diacetate

**Food applications....**

- **Frozen dairy products like ice-creams, sherbets, frozen ice candies, yoghurt, milkshakes, lassi, buttermilk, flavoured milks, chocolate milk, soft ice creams, soft cheese and cheesespreads.**
- **Puddings, mousses & icings.**
- **Jams, jellies, fruits spreads, fruit drinks, preserves, fruit toppings and sauces, fruit crushes.**
- **Water desert jelly (jello).**
- **Bakery products, cakes and bakery improvers.**
- **Canned foods**
- **Dry mixes-soups, gravies, ice-creams, milkshakes, flavoured milks, jelly, puddings, beverages, masalas, curries.**
- **Noodles and pasta products, ready-to-eat and semi finished foods products.**
- **Beverages and health drinks, low fat / low sugar foods, health drinks, slimming aids, high water soluble fiber foods, nutritional foods and beverages**
- **Flavours, oil-in-water emulsions and encapsulated flavours.**

**AUTHORISED DISTRIBUTORS IN INDIA FOR**

- ➤ **Jungbunzlauer (Austria)**
- ➤ **Maruha Corporation (Japan)**
- ➤ **Noviant (Finland)**
- ➤ **FMC (USA)**
- ➤ **Attisholz AG (Switzerland)**

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K. Desai - General Manager (Marketing) Extn No. 207, E-mail: kdesai@lucidgroup.com
M. Desai - Sales Manager (Industrial Application) Extn. No. 215, Email: mdesai@lucidgroup.com
D. Naik - Sales Manager (Food & Fine Application) Extn. No. 216 Email: dnaik@lucidgroup.com

For more information about our company and products visit our website *www.lucidgroup.com*
Address 401, Navbharat Estate, Zakaria Bunder Road, Sewri (W), Mumbai - 400 015 Tel: 091-022-4158059
Fax No. 091-022-4158074/75

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# PRODUCT REVIEWS

## FRUIT PROCESSING MACHINERIES

Since 30 years M/s. Techno-Equipments has been manufacturing and supplying high quality Fruit Processing Machinery to leading Fruit Processors.

The high quality of the machine as per the specification given is due to the expertise and dedication of Food Technology/Engineering in this field.

All machines are designed and fabricated under the supervision of Senior Technologists and experienced engineers, by maintaining strict quality control from procurement of raw material to the final assmbly under going rigid tests before it leaves the factory.

Techno-Equipments is manufacturing machines like Exhaust-box, Retorts, Steam jackets kettles with/without anchor type stirrers, Fruit Pulpers, Fruit Mills, Juice Extractors, Vacuum Bottle Fillers/Washers, Pineapple-slicers and Papaya Cubers with s.s. Tanks.

*For more details, contact:*

**Techno-Equipments**
9, Satyam Industrial Estate
Behind USV Ltd.,
Off. B.K. Devashi Marg
Govandi, Mumbai 400 088
Tel: 5515640

## LIQUID FILTERATION SYSTEMS

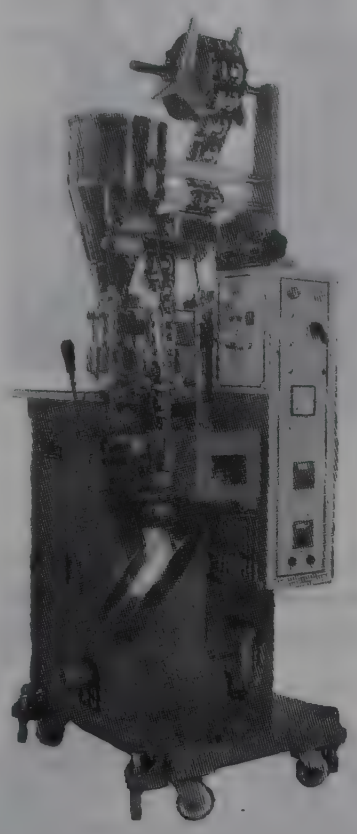
Mavish Engineering Works has brought to India for the first time the new concept for liquid filtration system instead of sparkler filter press/zero hold filter press. It is a compact steam jacketed unit for filteration for hot/cold liquids, beverages, chemicals etc. The unit is made of strong S.S. Tank with top covered & tightings 500 lts. per hour. It can also be made of S.S. 304 & S.S. 316 as per customer's need.

Their other product range include centrifugal monoblock pump, Rotary gear pump, Gear pump, Lobe pump, Liquid filling machines and turn tables.

*For further details, contact:*

**Mavish Engineering Works**
Hill View Apartments
C-402, Marol Military Road
Andheri (E)
Mumbai 400058
Tel: 8504375/8574376

## FORM-FILL-SEAL MACHINE



The fully automatic vertical form-fill-seal machine from Gurdeep Packaging finds application for packing any free flowing powder and granules, spices, soup-concentrates, soft drink concentrates, pharmaceutical powder, detergents, tea/coffee, pan masala, supari, confectioneries etc.

**Specifications**:

Sealing Type: 3 sides sealing/4 sides sealing. Packing Size: 50-120mm, or 100-240mm (film length). 20-160 mm, or 20-220 mm (film width). (enlarged type can be made upon order). Speed: 45-90 bags/min, 60-120 bags/min. (Depending on flowing rate and volume on packing objects). Packing Material: All heat sealable laminate PET/POLY, PET/FOIL/POLY MET, PET/POLY/CPP/OPP etc...

*For your requirements, contact:*

**Gurdeep Packaging Machines**
Harichand Compound,
L.B.S. Marg,
Vikhroli
Mumbai 400 079.
Tel: 5783521, 5772846, 5795982
Fax: 91-22-5772846

## ROTARY BOTTLE WASHER

Kothari Pharma, a manufacturer of a wide range of equipments for the pharmaceutical and chemical industries, offer Rotary Bottle Washer, a cost-effective, elegant-looking and highly efficient equipment as per GMP standards. Operating on the Rotary principle with 'Geneva mechanism', the washer is ideal for washing glass, plastic and other materials of bottles for the pharmaceutical and chemical industries. The rotating platform with a series of simple operation gives the bottles a clean washing within a short time. The bottle holder has a unique design to accommodate bottles with varying neck diameter and bottle diameter. External cleaning of the bottles is done by spraying showers. Timing and sequence of washing process can be regulated to suit specific requirements of the products to be washed.

The Rotary Bottle Washer has many unique features, which match GMP standards. The output is 64 to 100 bottles per minute. It is provided with four separate stations for inside wash and one station for outside wash. The specially designed cups are provided on the platform to accommodate any size of bottle in the range of 100 ml to 500 ml. Absence of rotating carbon plate eliminates leakage and minimises maintenance. The stationery washing nozzle ensures that there is no contamination from the wash water to the bottles. Individual solenoid valves for each wash makes the equipment the least complicated unlike the other conventional models available in the market. It is fitted with higher capacity centrifugal pumps for sufficient water and pressure required to wash large sized bottled (500 ml and 1000 ml). The machine can also be modified for washing 1000 ml IV fluid bottles, for which a maximum of six washing stations can be provided. The electrical load is 5 KW and the gross weight of the equipment is hardly 1,050 kg. And best of all, Kothari Pharma's Rotary Bottle Washer assures significant saving in water, energy and time.

*For further details, contact:*

**Kothari Pharma**
C/11, M.K. Bros. Indl. Estate
Jarimari, Andheri-Kurla Road
Andheri (W), Mumbai 400 072
Tel: 851 0837/ 2794, 859 2888
Fax: 91-22-8513485
Email: chandrakant@kotharipharma.com
Website: www.kotharipharma.com

## COLD ROOMS

Polaris Cold Rooms distinguishes itself by its exceptional versatility. It consists of individual modules that are designed to fit into any space and can be assembled into any form as required. Simple installation and perfect workmanship permit high performance and energy saving.

Polaris Cold Rooms with Cibin condensing units are suitable to preserve Fresh Fruits & Vegetables, Chilled Food, Dairy Products, Ice Cream, Frozen Food/ Meat, Pharmaceuticals, etc. and are available in various shapes & sizes.

*For further details, contact:*

**Hindustan Refrigeration Stores**
2, 4 & 5, Netaji Subhash Marg
Darya Ganj
New Delhi - 110 002
Tel: 011-3277725, 3277735, 3271898
Fax: 011-3271152
Email: higrop@ndb.vsnl.net.in

## DEHYDRATED ONION/GARLIC

Janak Dehydration Pvt. Ltd, was established in 1992 with the dynamic and pioneering zeal of N.L. Mehta with over 50 years of experience in the agricultural business. The company owns hundreds of acres of plantations in Mahuva, Bhavnagar, around its factory, which is located around 800 km from Mumbai.

The major crops being cultivated in their plantations are onions, garlic and other vegetables. All these products are processed and exported to all main European ports including Canada, Latin America, Australia, New Zealand, Japan, Korea, Taiwan, Hong Kong etc.

The company is managed by a professional team specially qualified in the field and having vast agricultural business background. The company has a total business turnover of 4000 MT of fresh onions annually. The total processing capacity is 6000 kgs of final product per day.

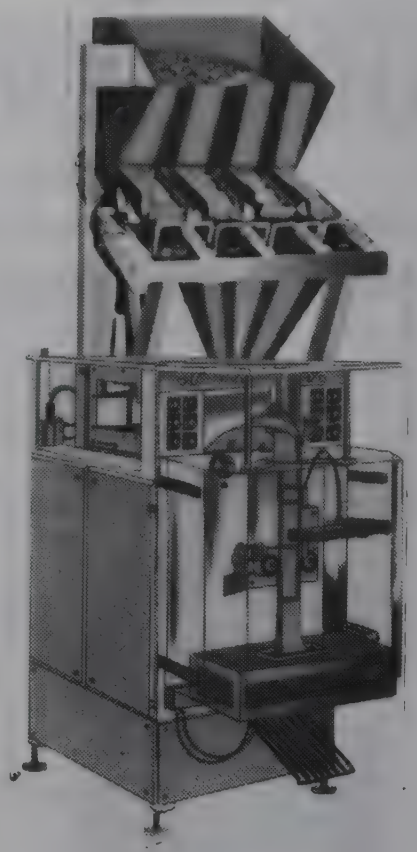
The company has its own warehouses with storage capacity of 5000 MT of raw onions. Janak Dehydration Pvt. Ltd. employs over 500 persons in its premises.

The Dehydrated Onions are available in three colours, white/red/pink - and in different forms like Flakes, Kibbled, Slices, Rings, Mince and Powder.

*For further details, contact:*

**Janak Dehydration Pvt. Ltd.**
B-305, Sunder Dham
Ram Baug Lane
Off S.V. Road, Poisar
Borivali (W), Mumbai - 400 092
Tel: +91-22-8074436, 8061113
Fax: +91-22-8612735
Email: jkmehta@bom5.vsnl.net.in

## FORM-FILL-SEAL MACHINE



The form- fill-seal machine from Unique

Flexo forms, fills and seals the package from the reel. The result is a sachet so tightly sealed that it keeps food or pharmaceutical products fresh maintaining its sterility. The separation of individual sachets can be reached either by a knife system or by a hotwire cut off system. All contact parts of the machine are of S.S. 304 grade.

This machine can be used for packing various products such as Milk, Juices, Tea, Coffee, Pesticides, Detergents, Oil, Medicines, Chemicals etc...

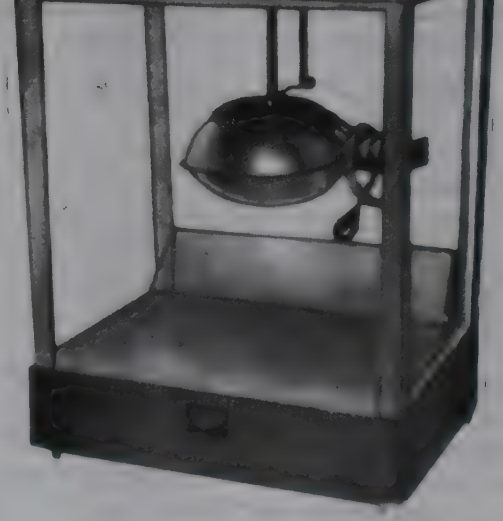
Salient features:

* Packs 15 gms to 1 Kg of powders and granules and upto 1 litres for liquids * Basic machine can be mounted with powder, granule or liquid filler * Automatic Batch Coding & Date of packing device provided * Speeds up to 45 pouches per minute per track * Available in Single and Double track models * Handles all types of heat sealable films * Optional photocell registration unit.

*For more details, contact:*

**Unique Flexo Packaging**
Gala No. B270, Off Manpada Rd,
Opp. Kasturi Plaza
Joshiwada, Dombivli (E) - 421 201
Email: unipack_2@hotmail.com

## POP-CORN MACHINES




The latest model of Pop-Corn machine has a corn warmer which keeps the ready Pop-corn warm, crispy, crunchy & fresh. It has a bottom heater plate alongwith the imported German Thermostat & an Air-blower which passes heated air through the pop-corn.

• Chrome Plated Aluminium /S.S. Kettle for a longer life • The machine is sturdily built having aluminium frame and illuminated bright coloured M.S. Top for saleability point of view • Heat-proof wire and thermostatic heat controller (optional) with light indicator for getting the crunchy and crispy taste of pop-corn • Best quality imported heating element for trouble free working hence giving low maintenance cost • Stirrer with vapour extractor is provided to keep the pop-corn fresh for a longer period of time and to attract customers through smell • this machine is ideal for eating / cinema / entertainment houses and at exhibitions, fairs etc. It is a well paying small scale business for people having a low budget.

*For more details, contact:*

*Attn: Mr. Ashit Shah*
**Nikko**
163, R.R. Mohan Roy Road
Opp. Canara Bank
Pharthana Samaj
Mumbai 400 004
Tel: 91-22-386 4641/3863117
Fax: 91-22-3873687
Email: nikko@vsnl.com
Website: http://www.winglobe.com/nikko

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## THERMO CHECKS

The Steinel Non-Contact Themocheck is designed to measure infrared emission from different products to measure surface temperature. The facility of long distance measurement with an accuracy of +/-1.5 deg. Centigrade gives precise assessment of surface temperature.

This handy and portable non contact format of accurately measuring surface temperature, accords precise determination of existing or potentially lethal faults saving the institution vast sums of money. The potential applications covered by our range of Thermochecks are • Surface Temperature: Meat, Soups, Coffee • Food Packaging & Shipping • Processed/Packaged Foods & Beverages & Confectionery & Microwaved Foods • Refrigerated & Random temperature checking on Foods placed in freezers • Random checks on refrigerators • Measurement during mixing (e.g. paste, rubber, pastry) • Spot checks on refrigeration counters and chambers, sale and service counters, groceries • Rotary Cooker Temperature Continous Infrared Ovens & Mixers & Continous Baking Ovens Plant Maintenance • Boiler Hot Spots and Boiler Rooms, Chilli rooms and Cold storage chambers for housing perishable goods • Energy Auditing Electrical Buss Bars & Steam traps • Temperature monitoring of Heating Coil Sets in Chamber Ovens • Heating & Air Conditioning • HVAC Systems & Residential Energy Efficiency.

**Salient Features of the Thermocheck:** • Visual Scanning field with Laser Sighting of object with LCD Display panel • Long Distance measurement upto 20 inches [20"] • Setting of emissivity for various applications • Hold function for storing data readout. • Auto shut off. 1000 operations will 9V Alkaline battery • Range of temperature - 30°C to 300°C. Audible Beeps if temperature limits are exceeded • Accuracy +/-1.5°C Temperature readouts in Centrigrade • Microprocessor Controlled

*For further details, please contact:*

**Pamvi Exports Pvt. Ltd.**
B-504, Remi Bizcourt
9, Shah Industrial Estate
Off: Veera Desai Road
Andheri (W)
Mumbai 400 053
Tel: 91-22-6327621/6327294/6318449
Fax: 91-22-6326280/6344083
Email: pamvi@vsnl.com
Website: steinel.delen

## LIQUID LEVEL SWITCH

Endress+Hauser are manufacturers of Liquiphant T FTL 260, a level switch for liquids. Level limit switch Liquiphant t is univerally applicable. It is also used in all those applications where float switches are not suited because of build-up, turbulences, currents, air bubbles etc.

**Measuring Principle:** The fork of the Liquiphant is driven by a piezoelectric crystal to vibrate with its resonance frequency of 400Hz in air. When immersed in a liquid, the filling material changes the oscillation frequency. The fork oscillates then at a frequency between 120Hz to 350Hz is liquid. This change in frequency is the basis for the measurement in levels. Outside this frequency range the instrument will recognise a malfunction and will indicate the alarm. The change in oscillation frequency occurs during immersion due to the change of the density from air into liquid as well as the length of the fork. A non-stop operation of the liquiphant is guaranteed if the minimum density of the liquid is more than 0.7g/cm$^3$ and with a viscosity of upto 10000mm$^2$/s. The switching signal is either a PNP transistor or a two wire AC (19-253V) output.

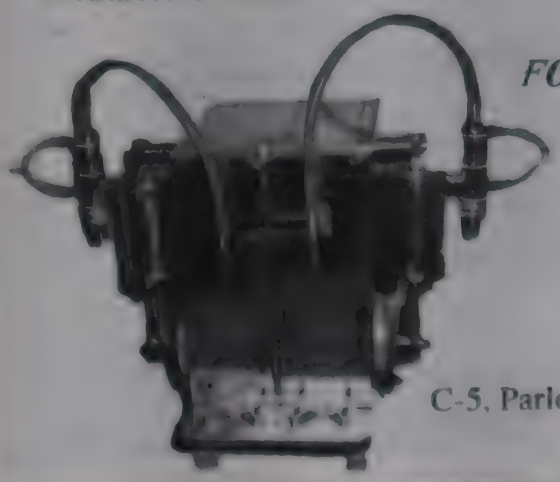
**Installation:** Tuning forks, used in level measurement, are mounted close to the height of the limit and or lower levels, usually at the side of the silo. The mounting position should be considered so that the filling does not affect the function of the sensor. If some basic rules are considered, these tuning fork are universal and reliable limit switches. Solid state electronic require no maintenance, no setup, no calibration or trained personnel.

*For further details, please contact:*

***T Product Division***
**Endress + Hauser India Pvt. Ltd.**
Excom House
7, Saki Vihar Road
Andheri (E), Mumbai 400072
Tel: 693 8351/6938333
Fax: 6938330
Email: biju.sumughan@in-endress.com


# CHHAYA ENTERPRISE

Volumetric Filler



**Manufacturers of**

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&

*MACHINERY SPARE PARTS*

C-5, Parle Colony, Sahar Road, Vile Parle (E), Mumbai 400 057
Factory Tel: 832 9259, Resi: 820 5584

Colloid Mill

## QUICK CONNECT FITTINGS

Ace Technologies is one of the leading companies in India dealing in Dispensing and Vending machines, Packaging machines and Innovative Industries products.

Ace has tied up with " **John Guest Limited, U.K.**" to market their complete range of "Quick Connect Fittings" in the Indian market. John Guest is the world's leading manufacturer of Quick Connect Fittings which finds applications in the following Industries.

- Food and Beverages
- Water applications
- Pneumatic applications
- Plumbing and Construction Industry

The Super Speedfit push-in fittings, provide a fast and secure way of connecting tubes and offer considered advantage over conventional fittings. Complex tubing systems can be assembled more rapidly than with traditional methods because superpseed fittings are easy to disconnect and maintenance becomes a much easier operations.

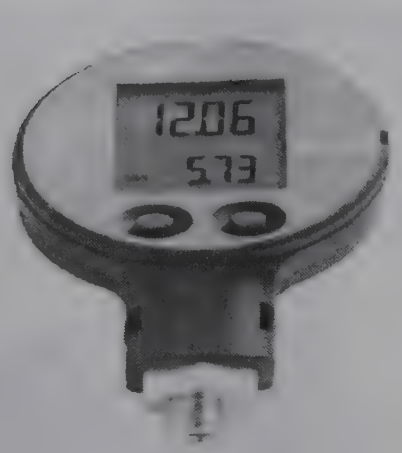
Advantage of Super Speedfit fittings

- Suitable for inert gas, liquids and vacuum
- Fast installation
- Suitable for metal and plastic tubes
- No tools needed
- Quick connection and disconnection
- Can be reused many times
- Superior flow characteristics
- Wide range of sizes and configurations
- Fittings are produced in FDA approved materials
- NSF51 certified - suitable for contact with foodstuffs
- NSF61 certified - suitable for potable water systems

*For further details, contact:*

**Ace Technologies**
8, Hare Rama Hare Krishna Indl. Estate
I.B. Patel Road
Goregaon (E)
Mumbai 400 063
Tel: 22-8768034, 8734932
Fax: 22-8116196
Email: acetechnologies@vsnl.net

## DIGITAL PRESSURE GAUGE




*Waaree* brings you the world's best digital pressure gauge made by Keller , Switzerland. The digital gauge having the stable piezoresistive sensor has unique self unit selection and with range form vaccum to 1000 bar. The LEO2 gauge can read the minimum and maximum value till last reset and the LEO1 model is for measurement of peak value. The peak value is measured at the rate of 5,000 readings per seconds. The gauge is operated by small lithium battery and the life of battery is 360 hours when operated countinously. The diaphram material can be Hast-c, Monel, Nickle or other material. The ex-proof version is available for hazardous area. The accuracy of this **low cost** gauge is 0.1 %,0.2% F.S. with option of data connectivity and the density calculation facility, the gauge are the an ideal replacement of analogue master gauge. Very small in size and light weight makes it ideal companion for on site calibration of pressue gauge or transmitters or switch.

*For more details, contact:*

**Waaree Instruments Limited**
36,Damaji Shamji Complex
Behind Sanghi Oxygen
Off Mahakali Road
Andheri (East), Mumbai-400 093
Tel : 91-22-8204778
Fax . 8321273
Website :www.waaree.com
Email : udaydharia@waaree.com

## WALK IN COOLERS/FREEZERS

Premier was founded in 1988 concentrating on the development, production and marketing of industrial / commercial refrigeration systems in India. Today the company is a leading manufacturer of industrial chilling systems known for setting standards in an otherwise disorganised sector. Premier has three different divisions to take care of customer interests: 1. Industrial Process Division 2. Commercial Equipment Division 3. Food Refrigeration Division.

Premier has a global outlook and keeping this in vision they have business associations with some international companies.

Premier is the authorised distributor for Technoblock Cold Room Units & Cold Room Panels of Refrigeration SPA of Italy in India. Premier builds and installs custom-designed pre-fabricated walk in coolers/freezers. Technoblock is an ISO 9001 & CE certified company and they have received international recognition for quality standards.

Premier-Technoblock units can be used to maintain temperature of +5°C to (-) 50°C It is one of the largest companies in the world & they market their products globally in more than 160 countries and they make more then 40,000 units annually.

Refrigeration units include: ● Variety of installations ● A wide choice of models for each series ● Quality of materials used ● Care in manufacturing & testing ● Particular attention to the development of new techniques, to the employment of new materials and to the European standards.

Features: ★ Wall mounting/Ceiling Mounting & Split System ★ Hermetic or semihermatic compressor★ Condensation by air or water ★ Electronic control on the unit or the remote control panel, defrost by air, by hot gas or by heaters.

The panels are available in Polyurethane thickness of 60 mm to 160 mm thickness with width of 500 mm to 1500 mm. The panels are of international standard density 40kg/m³. The fixing is by camlock arrangements embedded in the polyurethane. The polyurethane is sandwiched between two sheets. The floor insulation are base panels or slabs with vapour proofing and with marine ply and aluminium chequred plate.

Premier installs and maintains an extensive range of structures from modular coldrooms and massive coldstore complexes to fireproof freezer rooms. Special environmental Test Bed Structures, accoustic panels and sound baths.

*For further details, contact:*

**Premier Refrigeration Limited**
1 Akurli Ind. Est., Akuri Road
Kandivali (E), Mumbai 400 101
Tel: 91-22-8870305 (5 Lines)
Fax: 91-22-8841275
Email: premierchiller@vsnl.com

## LAB INSTRUMENTS

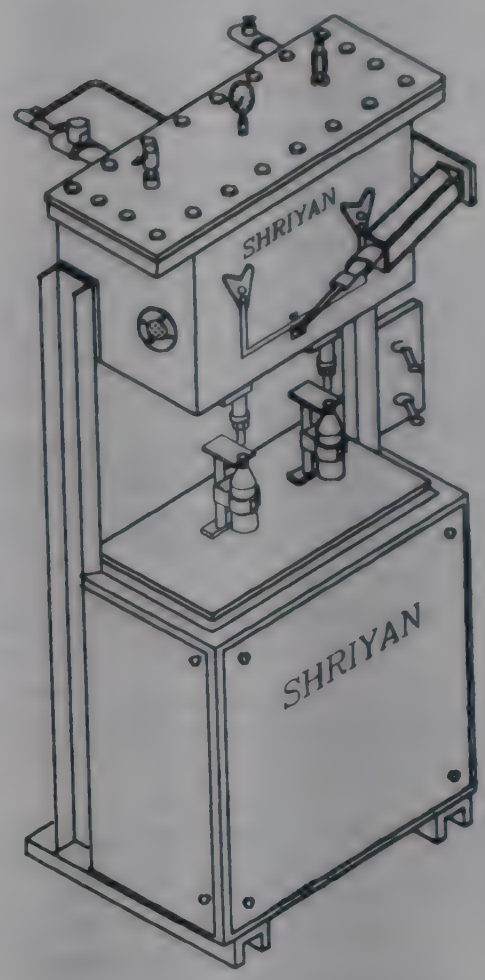
**Biobusiness** is a professionally oriented organization, established in 1976, engaged in marketing of the most sophisticated instruments, chemicals and plasticwares in the area of Biotechnology and to provide technical consultancy services for designing and getting up of biotechnology laboratories. Biobusiness is the exclusive and authorized distributors and stockists of SOCOREX, Switzerland who are the world leaders in manufacturing of Micropipettes, Bottles Top Dispensers, Repeater Pipettes and Syringes with three years warranty.

These products are used by R&D laboratories, Universities, Medical Colleges, Blood Banks, Clinical Laboratories, Pharmaceuticals, Food, Fertilizers and Petrochemical industries. The source of Chromatography • HPLC Columns from Machinery Nagel Germany • HPLC Columns from Thermoquest Hypercll, UK • HPLC Columns & Syringes from HP/Agilent Technologies, USA • HPLC Columns & Syringes from SGE International, Australia • Syringes from Hamilton, Switzerland • Injectors and accessories from Rheodyne, USA •Cuvettes for Spactrophotometers from Hellma, Germany • Deuterlum Lamps Hollow Cathode Lamps from Cathodeon, UK • Burettes from Brand, German • HPLC Reagents & Solvents Dehydrated Culture Media Autosample Vials/Septa, Membrane & Syringes Filters, Filter Paper & Holders, TLC Plates, Ultrasonic Cleaners, BOD Measurement System-Mercury Free, Ultrasonicator, Lovibind Comparators from Labortechnik, Germany.

*For further details, contact:*

**Biobusiness Development Agency**
C-76, Fateh Nagar
Jail Road, New Delhi 110 018
Tel/Fax: 091-11-5596820
Email: Prabhjyot@mantraonline.com

## COUNTER PRESSURE (SEMI) FILLING MACHINE




Shriyan Enterprises are manufacturers of carbonated and non-carbonated packing machinery. They also manufacture counter pressure (semi) filling machines which are used for filling soda/soft drink in pet/glass bottle in various size from 250ml to 2500ml.

*For more details, contact:*

**Shriyan Enterprises**
B/5, Gr. Flr
Ghanshyam Industries Estate
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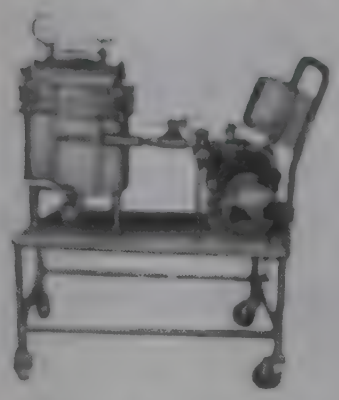

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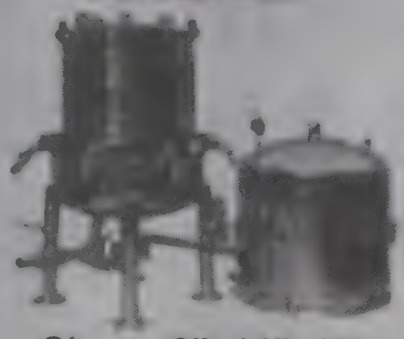

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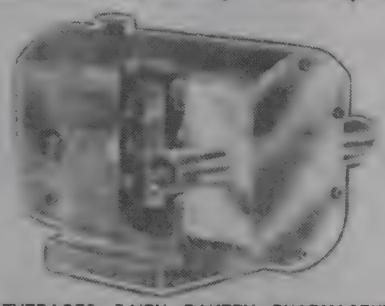

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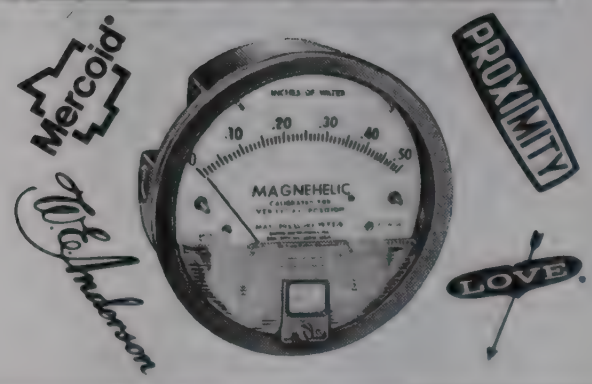


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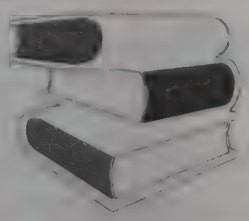

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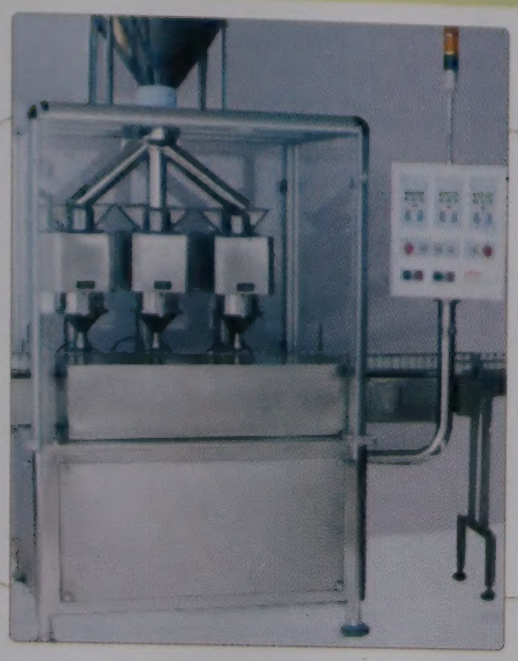

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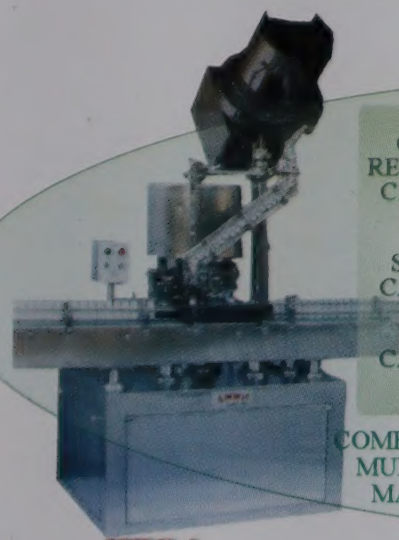

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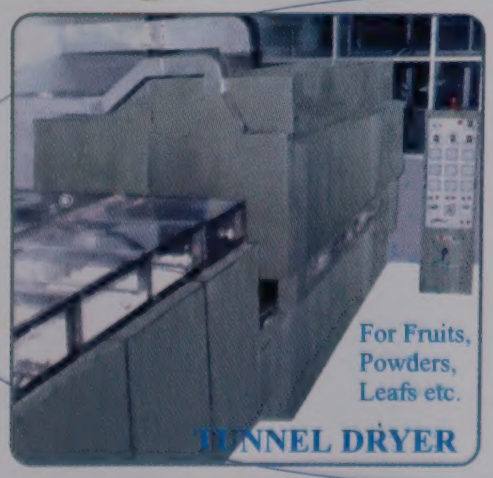

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